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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it. Editorials are by the Editor-in-Chief unless otherwise indicated and do not necessarily represent the opinion of the Society as a whole. The "leaders" preceding major articles are to be regarded as editorial additions.

EDITORIAL

Politics versus Efficiency in Government

IN TIMES of widespread suffering and loss of confidence, new men and new forces are given a sudden lease of life. Changes, sometimes of a revolutionary character, are inaugurated brusquely with scant opportunity for public consideration and approval or condemnation. The slow sane processes of orderly government are brushed aside impatiently, and urgent need is met with summary legislation and edict.

Without desiring to question the necessity or general benefit of the war on depression, and granting to the full the uplifting, stimulating effects upon forestry of such measures as the Emergency Conservation Work, let us take a look at the camp followers who have attached themselves to this army. For in times of change the adventurer and the buccaneer are equally active with the statesman and patriotic leader.

The unmistakable trend of recovery measures is towards greater governmental control of private industry, in restraint of individual initiative when harmful to the general welfare. Foresters understand just what this means in their own field and welcome the progress towards better practices on private forest land and increased public forest holdings.

But at the very moment when the government in this and many other lines is taking on huge new responsibilities, we note a sinister revival of that cancer of democracy, the spoils system of party politics. Perfected in Andrew Jackson's time, this system has been the consistent foe of public welfare, prostituting government to the service of professional privilege seekers and leading logically to the most astonishing corruption and waste. Yet in this administration the spoils system has again been boldly proclaimed and enforced by an officer of the President's cabinet.

It is claimed by politicians that the system is necessary in a government conducted by parties, and that it is not inconsistent with efficiency. Both of these claims are specious and false. This system is intended to benefit only the professional politician and keep him in office in defiance of public will. It neither benefits nor tends to carry out the policies of the public, but instead, works to defeat those ends by breakdown of governmental efficiency and substitution of fraud, bribery and coercion for response to public sentiment. It is the curse of every honest public servant, who would gladly be rid of it. A party succeeds or fails ultimately on its record of performance, not on the monopoly of funds and

power for partisan profit. As for the possibility of combining efficiency with partisan appointments, the matter has been summed up by Mayor F. LaGuardia whose statement published in the *New York Times* of March 2nd may well be regarded as authoritative:

"Economy and politics simply do not blend. Efficiency and party advantage simply do not know each other. Where pressure is brought to bear upon an executive or appointing officer for the appointment of a certain individual it is not based on his particular qualifications or experience, training or fitness for office but based entirely upon past political services of that individual, otherwise recommendation would not be necessary."

Again, in the *Antioch News*, the publication of the well-known college of that name, appears on February 5th the following:

"Control by irresponsible economic power has tended to displace government for the general good. Today there is a chance that the general good may regain control. The contest will not be easy. To dissipate our chances may destroy hope of victory for the general interest. *The spoils system for appointments to public office does dissipate this hope.* Unless America awakes to the great issues involved, the habit, so general in American politics, of filling office to sustain political power rather than best to serve the public interest may be the rock on which democratic government will be wrecked. Fitness to exercise political power in the present crisis can be partly measured by observing whether the primary concern is efficient conduct of public business or whether it is a building of personal or party power through the spoils system."

Finally, the *Saturday Evening Post* of March 17th editorially comes close to the heart of the problem.

"It is a discouraging fact that practically every new agency inaugurated under the New Deal has been exempted by Congress from operation of the Civil Service, or merit system. This strikes a blow at the very fundamentals of effective government. After the finish there will be dirty dishes to wash and the task will fall on the rank and file who must carry on. Even as it is, the concept of public service in this country is too low to attract to it the best of the young men who graduate from college. Yet our form of government cannot endure if we continue to sneer at the public service and unless the ideal of such service appeals to the best of youth.

"The work of the country goes on through the operations of the average, the forgotten, the humble, the rank and file employee. It is a poor service to the country to weaken or debase his standing."

From three decades of experience it has been abundantly proved in both national and state forestry organizations that the only possibility of successful administration lies in absolute freedom from the spoils system of appointments. The establishment of nonpolitical personnel offers the only reasonable possibility of securing for public service professionally trained foresters, and without such services public forest administration becomes a ghastly farce.

The announced and enforced policy of appointing only members of the party in power to all nontechnical positions in the Emergency Conservation Work has for the first time in its history given the U. S. Forest Service a political problem to cope with in the effort to secure efficiency in spite of this handicap. But this is not the greatest danger.

It is inevitable that as the result of the huge increase in the public debt, a drastic curtailment of the regular appropriations of the government will be attempted. The budget for 1935 has clearly indicated this intent. On whom will this cut fall?

On none other than the professional men who, in forestry as in other scientific lines, have chosen public service as a life work, and who have been solely responsible for the success of forestry enterprises including the Emergency Conservation Work.

What the ultimate financial outcome will be cannot be foreseen at this time. But it is well said that the fitness to continue the exercise of political power by the present regimé can be largely measured by the intelligence shown in protecting the trained personnel of the government against the most dangerous and far-reaching effort to substitute partisan control that has been seen since Jackson's day.

Of the members of the Society of American Foresters sixty per cent are in regular federal and state service, not including the numerous foresters employed in the temporary emergency work. The colleges of forestry *have* given of their best to public service. The spoils system, logically applied, is diametrically opposed to such professional employment and cannot be reconciled with efficiency in forest conservation. If America is to restore her wasted forest heritage the spoils system in public administration must be destroyed.

H. H. CHAPMAN.

FURTHER PROGRESS AND ACCOMPLISHMENTS UNDER THE LUMBER CODE

By FRANKLIN REED

Executive Secretary, Society of American Foresters

The following is a continuation of the story, under the same title, in the April issue of the JOURNAL, pages 400-404.

ON MARCH 25, President Roosevelt announced his approval of the supplement to Article X and the amendment to Article VIII of the Code of Fair Competition for the Lumber and Timber Products Industries, in substantially the the same language as given on pages 304-307 of the March, 1934, JOURNAL. Article X of the Lumber Code, with these changes, is now officially known as Schedule C of the Lumber Code — Forest Conservation Code. Official copies may be obtained on request and the executive office of the Society will be glad to see that they are supplied to any member of the Society or subscriber to the JOURNAL as may desire them.

Concerning the proposed amendments to Article 2 of the Lumber Code, the hearing on it on March 12 was reported in the April JOURNAL, no action as yet has been announced by the NRA.

On April 2 the Lumber Code Authority and its special administrative agency, the National Lumber Manufacturers' Association, announced the appointment of John B. Woods of Longview, Washington, to assist in the administration of the Forest Conservation Code. Mr. Woods has been a Senior member of the Society since 1921. For several years past he has been connected with the Long Bell Lumber Company as its forester.

Division 2 of the NRA, which has to do with the Lumber Code, of which Captain E. A. Selfredge is the Deputy Administrator in charge and Mr. A. C. Dixon, formerly of the Booth-Kelley Lumber Company, is First Assistant, has recently appointed Henry A. Meloney and C. Stowell Smith, both members of the Society of long standing, as Assistant Deputy Administrators.

The Conservation Conference's Joint Committee on April 5 held a luncheon meeting to devise ways and means for expediting the public part of the Article X program. Those present were: Henry A. Wallace, Secretary of Agriculture; R. G. Tugwell, Assistant Secretary of Agriculture; J. D. Tennant, Chairman of the Lumber Code Authority; Alfred R. Glancy, Divisional Administrator of NRA; A. C. Dixon, Deputy Administrator of NRA; F. A. Silcox; Wilson Compton; E. H. Clapp; F. G. Wisner; Burt P. Kirkland; Franklin Reed; Ed. R. Linn; D. T. Mason; W. B. Greeley; B. F. Heintzleman; W. duBois Brookings; Ovid M. Butler; E. E. Carter; and J. B. Woods. David T. Mason, as Chairman of the Joint Committee, presided.

Mr. Silcox gave a brief summary of the legislation intended to give effect to the public's part of the program, which includes forest acquisition by outright purchase, exchanges, donations and transfer of public lands and O and C lands; enlargement of contributions for the protection of forests from fire, insects and disease; provision for advice to forest owners; supply and testing of forest tree seeds; supply of nursery stock; research to round out existing provisions; public loans to facilitate long-time carrying of timber reserves and help owners and states over the present local tax emergency; administrative order to bring under the Lumber Code all timber producing lands not included under present

or proposed Codes; proposals to impress governors and state legislatures with the necessity of immediate taxation reform; proposals for study and legislation in respect to forest products markets, tariffs, etc., for the encouragement of domestic forest production. It was stated that the acquisition program represents an annual expenditure running from $46,000,000 to $52,500,000 and is expected to extend over a period of 15 years. He further stated that this forestry enterprise is an important part of the national land problem, as it affects one-third of the total land area of the United States.

Mr. Tennant read the following resolution which had been unanimously approved by the Control Committee of the Lumber Code Authority on March 31, 1934:

"WHEREAS, with respect to conservation and sustained production of Natural Resources, Article X of the Code recognizes the mutual responsibility of the industry and of the public

"WHEREAS, in accordance with Article X, the conference therein provided for has recommended a program of public action and a program of industry action.

"WHEREAS, the Lumber Code Authority has adopted as a Code amendment Schedule 'C', which gives effect to the recommendations of such conference for industry action, and

"WHEREAS, the President has approved Schedule 'C'

"WHEREAS, the degree of success with which the industry can apply Schedule 'C' depends upon the degree to which the public carries out the conference recommendations for public action, therefore

"BE IT RESOLVED, That the Control Committee of the Lumber Code Authority earnestly urges that the Secretary of Agriculture and the President promptly take the necessary steps to give effect to such conference recommendations for public action."

He stressed the fact that the industry has accepted seriously and enforced the Lumber Code and it accepts with equal seriousness the Forestry Supplement. He stated that his own experience, over a period of 10 years, in trying to fit forestry into lumbering under varied conditions from Alabama to Washington, has demonstrated that private forestry could go forward only with public aid in such matters as forest protection, taxation and finances. He stated that as this public program takes form and fulfills the expectations of its proponents, the industry's response will continue to be most gratifying.

Dr. Compton stated that the industry and public agencies stand today at the place where joint action is demanded and where its results will effect a fundamental change in the handling of one of our greatest resources. He suggested this far-reaching development would be a fine product of Secretary Wallace's administration and that the opportunity now exists to go forward that has never existed before and may not exist again. He offered industry's best efforts to help make the proposals law.

Mr. Greeley described the steps taken in the Pacific Northwest, to make effective the recommendations of the Forestry Conference and stated that he assumed the same work was going forward in other regions. He stressed particularly the importance of increased fire protection funds and cited the Tillamook burn of 1933 as a catastrophe that must be avoided in the future by intensification of fire prevention.

In response to the Chairman's invitation, the Secretary of Agriculture stated that he was deeply interested in this matter and had heard most of these facts stated at various times before, and asked specifically, "What shall we do?" He further stated that legislation intended to give effect to the public program is drafted and the present task is to convince the President that it deserves priority. He pointed to the fact that $60,000,000 a year, which approxi-

mates the total expenditure for this entire program, is a lot of money and even though there is favorable sentiment in the White House toward this program, resistance is apt to develop in Congress because of the amount involved and because of a number of other measures of major importance demanding attention. He stated that Mr. Tugwell had had this matter under his immediate supervision and he would be glad to have further representations from both Mr. Tugwell and Mr. Silcox, and that he would present the matter to the President in company with them.

After Secretary Wallace and Mr. Tugwell had left, the Committee continued its session to work out more in detail its plans for continued action. Mr. Silcox reported that the President had asked his secretary, Mr. Louis McH. Howe, to ascertain what percentage of CCC boys have obtained jobs since discharged; the army reports 40 per cent so reemployed, but the relief agencies say not over 10 per cent. The President has asked if the industry can use these boys in fire protection work, providing the government supplies subsistence. The idea might be to have small camps without army overhead, the men in these camps working for their board and doing forest improvement tasks that are non-competitive. Mr. Silcox said he would like to be able to tell the President that the industry is receptive to this idea.

Mr. Mason mentioned difficulties, but suggested that some adaptation of the California relief camps might be used in meeting this problem. He stated that in his opinion several of the larger companies might enter into such coöperative arrangements.

Mr. Woods suggested that this might be worked through fire patrol organizations and state foresters and used by them to fill some of the gaps occasioned by the withdrawal of most of the state CCC camps.

Mr. Tennant asked why this scheme should not be applied to insect and disease control work, with particular reference to the yellow pine beetle.

Mr. Silcox stated that in his opinion this conservation matter should be organized by counties and the boys registered through local boards.

Mr. Butler asked how many will work for their board. There was some discussion on this point, the consensus of opinion being that a sufficient number would respond to make use of whatever facilities can be obtained and the result will be beneficial.

The committee then proceeded to a discussion of plans for developing Congressional and public support to the proposed new forestry legislation. A second meeting on the following day was held at which a sub or legislative committee, on which Franklin Reed represents the Society, was appointed to carry on with this line of work. This legislative committee met on April 9 to perfect its plans for action.

Mr. C. S. Chapman, as a member of the Joint Committee, and William L. Hall, are returning to Washington shortly to give their assistance in this work. Mr. B. F. Heintzleman has been selected by the U. S. Forest Service to head up its share of the Article X undertaking. Mr. Heintzleman for several years past has been in charge of the Forest Service timber sale and management work in Alaska. He is now in Washington on his new job.

THE TEST OF CODE AUTHORITIES AND TRADE ASSOCIATIONS[1]

By WILSON COMPTON[2]

N.R.A. Chief of Trade Associations and Chairman Code Authority Organization Committee

This address is illuminating and important from the standpoint of private forestry whose progress and success is so largely dependent on the enforcement of Code Authority. Dr. Compton brings out the function of industry and the limitations of government in a manner which should attract the thoughtful attention of foresters. It is to be regretted that lack of space prohibits reproducing the statement in full.

CODE Authority is a new term, coined for a new purpose by a new administration. A Code Authority derives its powers from a Code of Fair Competition. It includes direct representation of the government. It has specific and limited functions. It administers a system of code law. It is in substance a semi-public agency charged with functions of both industry and public trusteeship.

Trade association, on the other hand, is a generic form. In popular usage it means any association in any trade or any industry. It may be local, regional or national in the scope of its representation. It may be general or specialized in its activities; and it may include or not include both production and distribution. . . .

It is said and said correctly that trade associations and code authorities are separate legal entities. But the only *important* difference between a truly representative and properly organized industrial association and a code authority is that the latter has specific and limited functions in the discharge of which there is direct appointed representation of the public. In those industries—and the number is increasing—which are supporting the spirit and not merely the letter, of the codes and of the National Industrial Recovery Act, this distinction is one more of form than of substance.

Codes of fair competition and code administration do by no means constitute the entire field of helpful coöperation in industry. The codes are essentially measures of industrial control or industrial regulation. They are in themselves not creative of economic advance. A code is not a substitute for a salesman. It will not sell products. It will not improve processes. It will not provide stimulation of research and invention. It will not of itself improve the manufacture and distribution, or promote the consumption, of the products of industry. These in many industries are a valid and fruitful field for coöperative action. Codes and code authorities as agencies of industrial control do not occupy it. It may, however, be occupied by alert trade associations as agencies of industrial progress. . . .

Industry still has a long way to go in organizing itself for competent self-regulation. At this moment there are 317 approved codes and only 168 properly constituted code authorities with reasonably adequate facilities. Right now the particular problem of code administration which *looks* biggest and probably at the moment *is* biggest, is code compliance and code enforcement. If compliance fails to keep

[1]Excerpts from address delivered in conference of code authorities and code committees, Washington, March 7, 1934.

[2]Also General Manager, Natl. Lumber Mftrs. Assoc.

pace with code obligations, industries, especially those which are highly competitive and have greatly increased their costs under the codes, face another bitter dilemma in which the honorable competitor may again have the choice of observing the code, playing fair and seeing the chiseler take his business—or of joining the chiselers. That is a choice which no honorable man should be required to make. The ultimate protection against it lies with the government of the United States. It is under its sanctions and its supervision that the codes are to be administered. Its responsibility is not avoided by delay nor its obligations discharged by inaction. A few visible object lessons will greatly strengthen the morale and determination of industry code administration. The prompt and decisive imposition, upon a few blustering and defiant chiselers, of the drastic penalties prescribed by the law will do more than *many* conferences to secure code compliance. It may be distasteful, but it is *less* distasteful than the destruction of thousands of enterprises which are trying to play fair, and the gradual deterioration of a million jobs.

But that is a problem by itself. It will be met constructively. In the long run, the great affirmative advantages under the system of codes will come, not from compliance, but firm deliberate industry planning. Compliance deals with the pathological fringe of industry. It is merely corrective if not negative. Intelligent industry planning, on the other hand, is a means of building industry health. It is, under the code system, the positive means to progress. . . .

There is yet another aspect. Codes are federal law. The United States Government is ultimately responsible for securing their observance and enforcement. Compliance with specific obligations plainly defined in a code is capable of definite measurement. Whether a code obligation has been violated is a question of *fact* capable of definite determination. But not so with obligations of so-called "normal code administration." There non-compliance means, not that the code has been violated, but that the industry languishes.

Therein lies ultimately the great opportunity for industry and for industrial and trade associations. It is not a field which can be occupied by government unless also all industrial initiative and all responsibility are likewise in the government and this is the exact opposite of the stated purposes of the National Industrial Recovery Act, the plain objectives of the codes themselves, and the declared intent of the Administration. Industry planning, improvement and progress must be accomplished, if accomplished at all, by industries themselves. The government can not do the thinking for the industries. . . .

In a national undertaking of this kind, each industry is directly concerned in the effectiveness of code administration in all other industries. There are, or will be, about 750 code authorities or industrial agencies responsible for code administration. All have a range of common interest in policies, standards and principles, if not in facts and methods. For the first time in national history, the code authorities represent for industry generally a responsible authority developed from the bottom up, and not as so frequently heretofore, superimposed from the top down.

I ask you this question:

Should there be established by the code authorities themselves the means for the pooling of facts, wisdom, and experience relating to codes, code policies and code government? Perhaps the greatest public and industry benefits to be expected from the opportunities and purposes of industrial self-government will come from the gradual determination by industry *itself* of sound national policies which will stand the test of public interest. For the stimulation and direction of this vital leadership, it seems to me that industry ought not to depend entirely upon the government.

THE ROLE OF VEGETATION IN EROSION CONTROL AND WATER CONSERVATION

By W. C. LOWDERMILK

Vice-Director, Soil Erosion Service, Department of Interior

Much is being said and written nowadays about erosion and flood control and watershed protection, in short, forest influences. It is well that the information forming the basis of programs of land management under consideration be thoroughly established. It is the only way for permanent advancement. While a voluminous literature on the subject of forests, floods and erosion exists much of it is controversial indicating incompleteness of scientifically established knowledge in this field. This paper by Dr. Lowdermilk who has been carrying on experimentation for a decade, briefly reviews, the status of our information on certain phases of the rôle of forest and other vegetation in erosion flood control and water supply, and indicates at what points investigations have been made and need to be made to bring the knowledge in this field up to date.

IMPORTANCE of indirect products of forest vegetation in national economy is increasing. Crowding of populations to which Taylor (43) calls attention, higher standards of living, general industrialization, increase of grazing herds, and extension of irrigation even into humid regions of capricious seasons, require consideration of forest and other natural vegetation as it affects recreation, hydraulic power, water supply, flood control, soil erosion, and useful life conservancy works. (36) As urban centers have grown and irrigation has been extended into semi-arid regions, water as a product of mountainous watersheds has reached in many sections values greater than those of timber, forage crops, or other uses. (12) Management of forested areas for the production and control of water has become of great importance in regions of multiple land use, and of first importance in semi-arid regions.

Status of Knowledge of Rôle of Forest Vegetation

Our knowledge of the interrelations of forest vegetation, climate, and streamflow is unsatisfactory. Contrary conclusions have been reached by serious students of: (1) Forests and rainfall; (2) Forests and climate; (3) Forests, streamflow and erosion; (4) Forests and water supply.

(1) Brookes (5) in his re-examination of the literature on forests and rainfall concludes that forests may increase rainfall 1 to 2 per cent, but additional moisture accrues under certain conditions by "occult condensation,"—fog and cloud drip, as described by Descombes (9). In this connection Hirata (21) reports 10 to 11 per cent excess of rainfall catch within forests over that in the open during periods of fog. Nicholson (34), however, reviews the work of Zon (45) and Brookes just cited, and indicates inadequacy of their generalizations when applied to specific conditions, such as exist in East Africa. In a review of Nicholson's paper, the writer (26) stated the conditions under which forests may influence rainfall significantly, and indicated the nature of information required to answer the question scientifically. Suffice it to say, that under the influence of land-ward monsoon winds, forests as contrasted with denuded landscapes play an important part in relaying moisture to the interiors of large continents. Specifically forest vegetation has been shown to influence the effectiveness of rainfall for vegetation by reducing superficial run-off losses. (7, 10, 24, 25.)

(2) Influences of forests on climate were overstated by the early investigators, Becquerel, Woeikof, Blanford, and Lorenz von Libernau, as recent more critical studies have shown (17). On the other hand important influences on micro-climate are being established in studies of forest stands and forest soils (op. cit. and 37). Forest vegetation plays a decisive rôle in succession of vegetation, reproduction of forest tree species, soil fauna, and soil characteristics. In this direction influences of forest and other natural vegetation will receive more and more attention in land use studies and in land management.

(3) Interest in forests, floods, and erosion has been revived in the past decade by experimental studies. Nevertheless divergence of findings in this field exist. Chittenden (6) is still recognized by many as an authority on the subject, although Swain (42) not only effectively refutes Chittenden's conclusions but draws others much more in agreement with recent experimental findings. Mead's findings on the rivers of Wisconsin (33) as well as those of Burr on the Merrimac (2) are frequently accepted as adequate bases for authoritative conclusions, despite the fact that these studies failed to satisfy the exactions of scientific method.

The two elaborate watershed studies, Emmethal in Switzerland (13), and Wagon Wheel Gap in Colorado (1) failed to show effects of actual denudation in comparison with those of a forest cover. Denudation, such as Cooke (3) thinks accounts for abandonment of Mayan cities in Yucatan, which Surrell (39) and Demontzey (8) combated in the French Alps, and which the writer described in China (23), were in no wise compared with forested lands in the Emmenthal and Wagon Wheel Gap studies.

The run-off plot method employed by Duley and Miller (11) for comparing influences of different crops on run-off and erosion began a new attack in determinations of this kind. The writer employed the plot method equipped with automatic recording run-off measuring devices first in China and later in California. Decisive influence of a mantle of vegetation on surficial run-off and erosion has been established by this method of experimentation (op. cit. 25).

(4) The relation of forests to water supply is more complex and has likewise given rise to contradictory conclusions. The chief reason for the contradictions is that the influence of forests on water supply has been recognized and only observed rather than measured. Catchment areas yielding water supplies to municipalities have generally been retained in forests, or such areas have been planted to forests by common consent and approval. Support of this policy exists where utility and regularity of flow rather than quantity of water control are the first consideration. In western North America the interests of stockmen and irrigationists have clashed. Divergence of findings of effects of range, browse, and forest vegetation on total water supply and its utility have been expressed by Forsling (15, 16) and Stabler (41).

It has long been recognized that forests consume relatively large quantities of water which varies widely between species. Ototzky (35) found in Russia that forests depress ground water levels below those of adjacent steppe or grass lands. More recently Halden in Sweden (20) found soil moisture to be less within the forest than in bare lands to depths of 1.0 meter. Exceptions occurred since conditions within forests favored more rapid percolation of rain water.

Forest cover has been supposed at the same time to increase storage of ground water and to provide conditions for greater regularity of flow and utility of supply (45). But demands on water supply have reached critical proportions in semi-arid

regions of rapidly growing populations and of prolonged droughts in more humid sections. In the face of serious water shortages, the desirability of maintaining a noncommercial forest cover has been questioned on the assumption that water losses due to transpiration may be recovered by destroying the forest vegetation. Hoyt and Troxell (22) have presented data of comparative streamflow before and after deforestation in Colorado and denudation by fire in southern California from which such a conclusion is drawn, but fail to present a complete picture of problems facing water conservation in California. The question is complex and essentially regional. Utility, control, as well as quantity, make up water supply. The question awaits adequate experimental determination for a satisfactory basis of watershed management under conditions of critical supply.

Reasons for Divergence of Conclusions

A basis for enlightened management of watersheds has not thus far been generally agreed upon for three major reasons,—reasons often lost sight of by past investigators: (a) Behavior of streamflow from a watershed is a resultant of a number of complex interacting factors whose isolation is an extremely difficult experimental procedure. General practice in such studies has been to attempt measurements of influences of a forest mantle,—a single factor—by streamflow from a watershed, which is a resultant of a number of factors. Variable results were inevitable, with the rôle of forest cover inadequately measured; (b) Factors which produce resultants in streamflow are not uniform in operation from place to place; they vary widely and often in different directions with respect to each other. Such factors cannot be treated as chemically pure reagents in laboratory reactions. The factors are now generally known; their evaluation, however, has not been adequately made; (c) Evaluation of component factors of a watershed complex is requisite to establish relationships of mantles of forest or other natural vegetation to micro-climate, to erosion, to streamflow, its quantity, regularity and control, and to furnish the basis of enlightened treatment of watersheds for water supply. A process akin to an algebraic summation of a number of plus and minus quantities is required for each region.

A Revised Approach to the Problem

In examining effects of disturbance by man, his domesticated animals, and his machines, upon regimens of streamflow, erosion, and other possible indirect effects upon climate, it is desirable to begin investigations with natural undisturbed conditions of landscapes. Such relicts of primeval vegetation facilitate comparative studies. Where, however, no relicts are extant, difficulties and uncertainties surround reconstruction of rates of normal processes. In such cases the most reliable procedure is to set aside areas protected from all major artificial influences, such as the use or destruction of natural vegetation, be it timber or grass, by grazing, trampling, lumbering, fire, clearing, or cultivation. In such areas natural vegetative succession will give within a few years a more accurate expression of the potentialities of control of run-off and erosion of soil, and of other factors under prevailing climate than any other contrivance. Norms of processes under conditions undisturbed by human or artificial agencies or their nearest approximations represent most stable natural conditions and are required for comparative studies of this nature. The manner in which natural controls function furnishes the bases for enlightened management of watershed areas for specific objects in national economy.

Interdependence of Vegetation and Soil

Soil coatings of a landscape under humid to semi-arid climates are the product of processes of weathering of the original rock material, influenced by climate, through time, under controls of a mantle of vegetation. Vegetation plays a remarkable rôle (18): it accelerates weathering; it supplies nutrients for myriads of soil micro-flora and fauna, and for burrowing animals (19, 14); it prevents rapid removal of soil by favoring percolation of rain water, and by protecting soil surfaces from erosive action of wind and flowing water; it yet again tends to retard rates of weathering of underlying rock (40) by favoring accumulation of a thick coating of soil. On the other hand vegetation is unable to develop to its climax without deep soil to furnish site, nutrient supplies, and water storage. A remarkable dependence of long standing exists between soils and their natural vegetation. Development of soil and vegetation has progressed dependently through periods of time often to be measured in geological terms.

The soil coating is at the same time subjected to erosional processes whose operations are reflected in sculpturing of landscapes. Erosional potentials are produced principally by gradients of land uplift, by precipitation, and by soil formation and texture. Under natural conditions within climatic regions supporting complete coverage of vegetation, the soil coating is subjected to the operation of erosional potentials under vegetative restraints. Topographic form represents the operation of erosional processes generated by erosional potentials as affected by geological structure, precipitation, soil formation, and the restraining influences of natural mantles of vegetation responsive to climate. Erosion under these natural conditions has been designated a "geologic norm of erosion" by the writer (27); McGee (32) refers to this concept as "old erosion." More recently the concept is less concisely designated "normal erosion."

Geological Norms of Erosion

The geologic norm of erosion as a concept is not a uniform phenomenon. It responds to varying supplies, intensities and character of precipitation, to faulting and geological structures, to land slides and to soil forming processes. It represents inevitable processes of degradation and planation of land forms above sea level measured in geological time units. Geologic norms of erosion may be reduced by dams for irrigation and other purposes; they may be considered as limits of practical measures of erosion control in drainages without dams and as a basis for measurement of acceleration of soil erosion.

Accelerated Erosion

Acceleration of erosion above geologic norms is a second important concept. It represents artificially augmented operations of erosional potentials caused by the removal of controls exercised by a mantle of vegetation. Destruction of native mantles of vegetation may be caused by fire, destructive lumbering, heavy grazing, smelter fumes, railroad and highway cuts, and clearing and cultivation for agricultural crops. Perhaps the earliest reference to processes of accelerated erosion is found in Isaiah 7: 23-25. Marsh (31) and more recently Turrill (44), the writer (23), Bennett and Chaplin (4) and others, have indicated effects of destruction of coverage of natural vegetation on accelerating erosion.

Differences between geologic norms and accelerated erosion are of vital importance in national economy. Such differences affect rates of soil removal in relation to processes of soil formation. Soils are rarely destroyed by erosion of geologic norms

or normal erosion. Accelerated erosion on the contrary proceeds at rates greater than soil formation, and destroys the soil. Degree of acceleration depends on continued mis-management of land. In areas, however, where delicate balances exist between vegetative control and erosional potentials, acceleration of erosion may proceed without natural check until utility of soil resources is seriously impaired or destroyed. Accelerated erosion is the chief agent of suicidal agriculture to which the writer has referred elsewhere (28).

Degree of acceleration of erosion through baring lands formerly covered with vegetation is dependent on a number of factors; such as, soil type, soil profile characters, character of precipitation, and climate. Little or no acceleration is caused by runoff from sand hills by removal of vegetation; wind, however, may set dunes in motion. On the other hand maximum acceleration occurs not in clay soils, but predominately in loam soils, especially when underlain by clay zones or beds. Evidences of acceleration of water erosion appear as gullies in fine rock-free soils, and as *erosion pavement* in soils containing rock fragments. More areas of serious accelerated erosion lie in rain than in snow belts. Finally, climate as it may favor or disfavor quick return of vegetation and active soil micro-fauna is an important determinant of degree of acceleration.

Significance of disturbances of delicate interdependence between vegetation, soil, and regimens of streamflow upon maintenance of land productivity has been variously interpreted. Conspicuous divergence of conclusions on relative influences of forests and other natural vegetation on streamflow and erosion is to be found in the voluminous literature on the subject, a review of which cannot be made here.

Analysis of Factors

Water being the principal factor in changes wrought in baring soil surfaces of a landscape formerly covered by vegetation, any experimental study of problems involved must begin with a consideration of supply and disposition of meteoric waters. The following analysis will indicate those points of a complex of factors on which experimental studies have been made and what phases require further study for an evaluation.

An Analysis of Supply and Disposition of Meteoric Waters

A. Supply of meteoric waters comprises:
  1. Amount and occurrences as:
     (a) Rain
     (b) Snow
     (c) Cloud drip
     (d) Fog drip
     (e) Intra-solum condensation
  2. Juvenile water from hot springs.

B. Disposition of meteoric waters comprises:
  1. *Retention*, being:
     (a) Evaporation from
        1. vegetation and foliage
        2. soil surfaces
        3. soil mass by vapor movement
     (b) Transpiration from
        1. Forests and other vegetation on drained slopes and valley plains
        2. Sub-irrigated valley and canyon bottom vegetation
     (c) Water of combination, to form
        1. Organic substances
        2. Hydrates of oxides and silicates in rock-weathering processes
     (d) Abysmal seepage.
  2. *Run-off*, being

(a) Ground water drainage (springs)
(b) Storm run-off, combining
1. Shallow seepage or discharge of wet weather springs.
2. Surficial (superficial run-off which represents unabsorbed portions of rainfall or melting snow.
3. *Deep seepage*, or deep percolation which escapes through rock masses without appearing in surface drainage channels.

Storm run-off is the dominant factor in norms and accelerated phases of erosion. This factor likewise causes flooding, protecting against which is costing enormous sums of money. Ratios between evaporation and transpiration determine degrees of influence of vegetation upon water-yield from drainage areas. These are the more specific responses. Influences of forest vegetation or its absence upon absorption of heat from sun rays and its radiation are more difficult to isolate as Geiger (op. cit.) has shown. Only a beginning has been made in determinations that may be of profound importance to enlightened land management for maintenance of favorable local climatic conditions and conservation of soil and waters.

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CONSERVATION ECONOMICS[1]

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The "New Deal" expenditures for conservation indicate that from now on damage to land is to be repaired at public expense. Misuse of land thus becomes a direct liability against the public purse. In the light of this new premise, this paper critically examines current programs for public land acquisition and for regulation of private land practice. It suggests prevention rather than cure of misuse, and the fusion of conservation laws into some single system for rewarding the private owner whose land-use serves the public interest.

THE moon, they say, was born when some mighty planet, zooming aimlessly through the firmament, happened to pass so near the earth as to lift off a piece of its substance and hurl it forth into space as a new and separate entity in the galaxy of heavenly bodies.

Conservation, I think, was "born" in somewhat this same manner in the year A.D. 1933. A mighty force, consisting of the pent-up desires and frustrated dreams of two generations of conservationists, passed near the national money-bags whilst opened wide for post-depression relief. Something large and heavy was lifted off and hurled forth into the galaxy of the alphabets. It is still moving too fast for us to be sure how big it is, or what cosmic forces draw rein on its career. My purpose is to discuss the new arrival and his prospects in life.

We must first of all understand the sequence of events which generated the lifting force. For the last half-century there has grown up a widespread conviction that our whip-hand over nature is no unmixed blessing. We have gained an easier living, but in the process of getting it we are losing two things of possibly equal value: (1) The permanence of the resources whence comes our bread and butter: (2) the opportunity of personal contact with natural beauty.

Conservation is the effort to so use the whip that these two losses will be minimized.

Its history in America may be compressed into two sentences: We tried to get conservation by buying land, by subsidizing desirable changes in land use, and by passing restrictive laws. The last method largely failed; the other two have produced some small samples of success.

The "New Deal" expenditures are the natural consequence of this experience. Public ownership or subsidy having given us the only taste of conservation we have ever enjoyed, the public money-bags being open, and private land being a drug on the market, we have suddenly decided to buy us a real mouthful, if not indeed, a square meal.

Is this good logic? Will we get a square meal? These are the questions of the hour.

Geography

The monumental Copeland Report on forestry, and some lesser labors in other fields, have recently shed much light on these questions, but it seems to me that we can further illuminate them by considering the simple geography of the phenomena which conservation seeks to control. Forests, erosion, and game each have certain characteristics and certain limitations affecting their dispersion over the land. Can these be made to fit the geographical pecu-

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liarities of public ownership? For instance:

1. Public lands are necessarily of limited dispersion.

2. The ratio of public to private land cannot exceed what the private tax-base plus operating revenues if any, will carry.

3. The minimum unit of public land must be large enough to carry a custodian.

Let us examine the geography of game in the light of these limitations. Wild game has an inherent intolerance of concentration. Few enthusiasts are aware of this simple but important fact. The most skillful culture cannot build a wild stand heavier than a bird per acre, or a deer per 20 acres. Take upland birds as an example. The safe limit of annual kill is one-third the population, hence under ideal conditions it takes 3 acres to put a bird in the hunting coat. Under the non-Utopian realities of actual practice it will likely take at least 6 acres. Perhaps half of Wisconsin is suitable to be cropped for birds. On this half the state could bag 3 million birds yearly, or 15 for each hunter now licensed. This is ample, but it assumes *all suitable land* to be cropped. By no stretch of the imagination could the public own all suitable land. Moreover, if it did, the land would no longer be farmed, whereupon its productive capacity for game would sink to a much lower figure. If the public owned and cropped a tenth of the state—3 million acres—it could produce only 5 birds for each hunter now licensed. What, now, is left for the unlicensed thousands who have leisure but no place to spend it, and for the non-residents who are the answer to the booster's prayer?

We can, to be sure, get heavier yields by artificial propagation, but the cost would be prohibitive and the esthetic quality of the product distinctly lower. It also happens that waterfowl differ from other game. They have no intolerance of concentration. Large-scale public ownership of marshlands, therefore, is feasible. It is also necessary, because the interstate movements of waterfowl render the incentive for their private production partially inoperative. Hence waterfowl stand is an exception to the rule.

It is clear, however, that the inherent dispersion of the phenomena dealt with in game management makes public game production a mere supplement to production on private lands. Game must grow as a by-product of other land uses. "Sport for all" is obtainable only by using all the land. Public game cropping as a sole dependence is excluded by the very nature of the game itself.

Consider, now, the geography of forests. Forestry is unique in that timber products can be grown in one place and used in another. This is not true of game or fish or erosion control, or scenery, or wildflowers, or birdsongs. Forestry is unique also in this respect: Consumption of timber products is not increasing. Hence it is probably feasible to relegate the timber-growing function to public lands. It is not, to be sure, a desirable solution of the forest problem, because the secondary functions of erosion control, wild life production, and recreation decline as dispersion decreases. Wood waste goes up as dispersion goes down. The social disciplines which private landowners might derive from timber-growing certainly are partly lost when the job is done vicariously by public agents. Until 1933, both foresters and lumbermen clung tenaciously to the theory that there must be both private and public forestry, despite the near-failure of all efforts to bring private practice into existence. Since 1933, however, there has been a virtual stampede for public ownership. Even Article X of the Lumber Code seems to be bending in the direction of a preparation for public acquisition of cutovers.

What, now, is the geography of soil erosion and floods? What is the dispersion of the phenomena which determines the regimen of the Mississippi?—which determine whether the topsoil on farms shall

stay where it is, or be dumped into the Gulf of Mexico? Unless science has utterly deluded itself, the answer is at variance with the recent trend of land policy. With as much certainty as we know whether swallows hibernate in mud, and whether the elements are fire, water, and air, we know that the dispersion of potential erosion is as universal as the dispersion of cultivation, grading, slope, and rain. How, then, shall we control it by purchasing a few headwaters and riverbanks and converting them into public forests? These spots are, I admit, usually the most vulnerable, and their public afforestation will, I admit, retard the degeneration of our soil and water resources, but will it assure the physical integrity of America in A.D. 2000, or even A.D. 1950? Most assuredly not. It is a geographic axiom that there is no such assurance except in the *conservative use of every acre on every watershed in America,* whether it be farm or forest, public or private. In the West are dozens of irrigation projects "protected" by a headwater-patch of national forest, each subjoined by a watershed on which overgrazing, fire, and dry-farming have run riot. Most of these "protected" reservoirs began to choke with silt before the ink was dry on their bonds. This disease of erosion is a leprosy of the land, hardly to be cured by slapping a mustard plaster on the first sore. The only cure is the universal reformation of land-use, and the longer we dabble with palliatives, the more gigantic grows the job of restoration.

Let us now examine the geography of that subtle, complex, and (barring agriculture) most important of all the uses of land: recreation. Recreation is a perpetual battlefield because it is a single word denoting as many diverse things as there are diverse people. One can discuss it only in personal terms. A sawlog can be scaled, and a covey of quail is 15 birds, but there is no unit of either volume or value wherewith diverse persons can impersonally measure or compare recreational use. Those who have opinions about it must admit, like Whitman, that

"Whatever the sounding, whatever the sea or the sail,
Man brings all things to the test of himself."

The salient geographic character of outdoor recreation, to my mind, is that recreational use is self-destructive. The more people are concentrated on a given area, the less is the chance of their finding what they seek. This is not true of the uncritical mob, but I see no more reason for running a national or state park to please the mob than a public art gallery or a public university. A slum is a slum, whether in the Bowery or on the Yellowstone. Dispersion, then, is the first principle of recreational planning. Dispersion of outdoor playgrounds has the equally important attribute of enhancing their accessibility.

It is inconceivable to me that the "leisure for all" revealed to us in Mr. Hoover's dream can be spent mainly, or even in large part, on public recreation grounds. Already the public grounds are so congested that the solitary recreationist must either invade such of their roadless hinderlands as may have temporarily escaped the CWA, or avoid them altogether. The expanding demand for recreation must in some way be spread over both public and private lands, or else, like Shakespeare's virtue, it will "die of its own too-much."

Let it be clear that I do not challenge the purchase of public lands for conservation. For the first time in history we are buying on a scale commensurate with the size of the problem. I do challenge the growing supervision that bigger buying is a substitute for private conservation practice. Bigger buying, I fear, is serving as an escape-mechanism,—it masks our failure to solve the harder problem. The geographic cards are stacked against its ultimate success. In the long run it is exactly as effective as buying half an umbrella.

Integration

It has always been admitted that the several kinds of conservation should be integrated with each other, and with other economic land uses. The theory is that one and the same oak will grow sawlogs, bind soil against erosion, retard floods, drop acorns to game, furnish shelter for song birds, and cast shade for picnics; that one and the same acre can and should serve forestry, watersheds, wild life, and recreation simultaneously. It required the open money-bags of 1933, however, to demonstrate what a disparity still exists between this paper ideal and the actual performance of a field-foreman turned loose with a crew and a circular of instructions on how to do some one particular kind of conservation work. There was, for example, the road crew cutting a grade along a clay bank so as permanently to roil the troutstream which another crew was improving with dams and shelters; the silvicultural crew felling the "wolf trees" and border shrubbery needed for game food; the roadside-cleanup crew burning all the down oak fuel wood available to the fireplaces being built by the recreation-ground crew; the planting crew setting pines all over the only open clover-patch available to the deer and partridges; the fire-line crew burning up all the hollow snags on a wild-life refuge, or worse yet, felling the gnarled veterans which were about the only scenic thing along a "scenic road." In short, the ecological and esthetic limitations of "scientific" technology were revealed in all their nakedness.

Such crossed wires were frequent, even in the CCC camps where crews were directed by brainy young technicians, many of them fresh from conservation schools, but each schooled only in his particular "specialty." What atrocities prevailed in the more ephemeral organizations like the CWA, he who runs may read. The instructive part of this experience is not that cub foreman should lack omniscience in integrating conservation, but that the high-ups (of which I was one) *did not anticipate* these conflicts of interest, sometimes did not see them when they occurred, and were ill-prepared to adjust them when seen. The plain lesson is that to be a practitioner of conservation on a piece of land takes more brains, and a wider range of sympathy, forethought, and experience, than to be a specialized forester, game manager, range manager, or erosion expert in a college or a conservation bureau. Integration is easy on paper, but a lot more important and more difficult in the field than any of us foresaw. None of us had ever had enough volume and variety of field labor simultaneously at work to be fully aware of either its pitfalls or its possibilities. If the *accouchement* of conservation in 1933 bore no other fruits, this sobering experience would alone be worth its pains and cost.

If trained technicians on public lands find it no small task to integrate the diverse public interests in land-use, what shall we say of the private landowner, scrambling for a hard-earned living, who has not even been told what these public interests are?

Legislation

It is a conspicuous fact that almost all our present laws and appropriations are single-track measures dealing with a single aspect of land-use. During the summer of 1933, it became an equally conspicuous fact that when applied to the soil these measures frequently clash, or at best, fail to dovetail with each other.

Take, for example, a hypothetical Wisconsin farm, and count the geeings and hawings which result from having a dozen drivers for a single horse.

First we have the AAA paying the farmer a bonus for taking land out of corn or tobacco. Is the farmer encouraged to reorganize his layout of fields so as to divert this idle acreage permanently to game, for-

estry, or erosion control? No,—that is not the business of the AAA. On the contrary, he is free to clear new woods, or push his pastures further up the hill, to the actual detriment of forestry, game, and erosion.

Again we have the CCC, building free check-dams in the farmer's gullies, and doing a splendid job of it. But does the CCC stipulate that he must pull his cows down off the steep slopes, and so revise his farming that new gullies will not form? To a very limited extent, and only in the most flagrant cases. The single-track approach is virtually precluded from revising other land uses so as to give permanence to the benefits it confers.

Again we have the Forest Crop Law, offering a tax rebate to those who practice forestry. Does the timber owner who makes his woods produce not only timber but also game, erosion-control, fur, or wildflowers, gain any preferred status thereby? Not at all, despite the fact that he may benefit the public ten times as much as he who practices forestry only, and despite the fact that the legislature which passed the law, and the conservation commission which administers it, are equally interested in these "side-issues."

This hypothetical farm may be in a fire-protection district which receives federal aid from the Clarke-McNary Law. The district may qualify as to fire, but be a public menace as to wild life, or recreation. These things, however, cannot sway the inspector who passes on compliance with fire-control standards. He must listen only to the rigid single-track definition of conservation embalmed in his particular single-track statute.

These bewilderments, of course, extend far beyond the conservation field. The public game farm restocks the coverts which the public highway crew has just burned up or cut down. Congress is about to tax duck hunters to restore the marshes which its own agents have caused to be drained. The Agricultural Colleges preach fences for the public grazing ranges,—the Interior Department prohibits them. Not all of these reversals are preventable—hindsight is better than foresight, and always will be; sincere public servants disagree on what is sound public policy, and always will. The list, however, is sufficiently impressive to raise these basic questions:

(a) Does the rigid statutory single-track definition of conservation attain even its own limited object? History so far answers: seldom.

(b) Can the private landowner be expected to integrate these uncoördinated definitions into a single system of land use? Not, I think, if government experts find it difficult to do so.

(c) When the taxpayer learns what poor teamwork exists between the various conservation dollars, will he be satisfied to roll more of them down the same old rut? I doubt it.

(d) If single-track subsidy or compulsion will not work, and if the alternative of public acquisition is not a solution, then what is the solution?

Economics

In attempting to throw light on this question, we must first examine briefly the time-honored supposition that conservation is profitable, and that the profit-incentive is sufficient to motivate its practice.

Forestry and erosion-control are often profitable *if started before deterioration sets in,*—seldom if started later. Advanced erosion is always unprofitable to control if regarded from the local viewpoint, but if one adds the cost of handling the floods and silting caused by the dislocated soil, it is cheaper to cure it at its source, even though the cost may exceed the value of the land.

Game management is profitable if some major crop carries the land and if the environment need not be rebuilt,—seldom if

the game alone must carry the land, or if the land is ruined.

Recreation and allied esthetic uses seldom offer direct income. They can usually be considered profitable only by the general public, and after crediting intangibles.

It is apparent even from this brief survey that:

1. Direct profits are operative only in spots.

2. Advanced deterioration usually precludes profits.

3. No balanced program can be built on profit alone. Public intervention is necessary.

4. Prevention, whatever the cost, is usually cheaper than cure.

5. Incentives are more promising than penalties, because penalties are *ex post facto*.

The wholesale public expenditures for 1933 indicate that from now on, whenever a private landowner so uses his land as to injure the public interest, *the public will eventually pay the bill,* either by buying him out, or by donating the repairs, or both. Hence the prevention of damage to the soil, or to the living things upon it, has become a first principle of public finance. Abuse is no longer merely a question of depleting a capital asset, *but of actually creating a cash liability against the taxpayer.* I hope the reader will ponder this well. It is a new frame for our picture which nullifies many pre-existing grooves of thought.

The thing to be prevented is destructive private land-use of any and all kinds. The thing to be encouraged is the use of private land in such a way as to combine the public and the private interest to the great possible degree. If we are going to spend large sums of public money anyhow, why not use it to subsidize desirable combinations in land use, instead of to cure, by purchase, prohibition, or repair, the headache arising from bad ones?

I realize fully that such a question qualifies me for the asylum for political and economic dreamers. Yet I submit that the proposal is actually less radical politically, and possibly cheaper in economic cost, than the stampede for public ownership in which our most respectable conservatives have now joined.

Let me illustrate. Last summer I participated in the building of hundreds of erosion check-dams, each string of dams costing a sum the interest on which is greater than the taxes from the land they protect. These dams were "cures," necessary ones. But how about prevention of land uses creating more gullies needing more dams? If the farmer or stockman had, in the first place, been offered a differential tax of, let us say, 25 per cent in favor of conservative use, perhaps no dams need ever have been built. The economic saving would have been 75 per cent. Politically, is it any more radical to offer careless farmers a differential tax than to offer them free dams?

The CCC camps are planting forests on many burned-over acres at a cost as yet unannounced, but it is certainly not less than the commercial cost of \$5—\$10 per acre. Would the dollar or half-dollar interest on this "cure," offered as a differential tax, have prevented the lumberman who originally cut the timber from allowing the fire to run? If the present forest tax laws do not offer sufficient inducement to prevent a repetition of the tragedy, is it not logical to consider "raising the ante," or even remitting taxes altogether, on such forest properties as safeguard the public interest? Is it necessarily cheaper or better to wait and buy the charred remains as a public forest?

Our game departments are artificially restocking grazed-out or burned-over coverts year after year at \$2.50 per bird, and often to no effect. How about paying the same sum to the farmer, in the form of differential taxes or shooting fees, for fenc-

ing cover spots, for feeding, and for posting the land? I know a thousand places where \$2.50 worth of fence or feed will produce not one, but *ten* birds per year, ad infinitum. It would require \$2,500, plus an annual bill for custodian service, to get the same results by public land purchase.

Let me at this point also plead for what may be called the "suppressed minorities" of conservation. The landowner whose boundaries happen to include an eagle's nest, or a heron hookery, or a patch of lady-slippers, or a remnant of native prairie sod, or an historical oak, or a string of Indian mounds—such a landowner is the custodian of a public interest, to an equal or sometimes greater degree than one growing a forest, or one fighting a gully. We already have such a welter of single-track statutes that new and separate prohibitions or subsidies for each of these "minority interests" would be hard to enact, and still harder to enforce or administer. Perhaps this impasse offers a clue to the whole broad problem of conservation policy. It suggests the need for some comprehensive fusion of interests, some sweeping simplification of conservation law, which sets up for each parcel of land a single criterion of land-use: "Has the public interest in *all* its resources been protected?" which motivates that criterion by a single incentive, such as the differential tax, and which delegates the function of judging compliance to some single and highly trained administrative field-inspector, subject to review by the courts. Such a man would have to be a composite tax assessor, county agent, and conservation ecologist. Such a man is hard to build, but easier, I think, than to build a law specifying in cold print the hundreds of alternative ways of handling the land resources of even a single farm.

It would perhaps be unnecessary for the law itself to define the public interest, nor for the inspector to adhere to a rigid unchanging definition through a long period of years. Such an elastic regulation of private compliance with public interest is already in successful operation in the Industrial Safety Service established by the Wisconsin Industrial Commission Act (Revised Statutes, Chap. 101).

I have administered land too long to have any illusion, or to wish to create one, that this idea of preventive subsidy is as simple as it sounds, but I doubt if it would be as complicated as the cures on which we are now embarked. Differential taxes, I realize, must reach far enough back into national finance to forestall the mere local shifting of the tax burden, and must be based on some workable criterion of good vs. bad land use. How to define it? Who to define it? Are differential taxes the best, or even a possible vehicle? I don't know. I do know that it would be hard to find a less workable criterion of that composite thing called conservation than the single-track statutes we now employ. Some of them may be tolerable as a definition of the single land-use with which each deals, but as criteria of the combination of conflicting or coöperating uses which constitute the actual land problem, they seem hopeless.

I am no economist, and no jurist. It seems clear, however, even to a layman that previous to 1933 the entire search for economic mechanisms was confined within the pre-existing limits sanctioned in our political and economic law and custom. It suddenly appears that those limits are too narrow.

Is this, after all, surprising? Our legal and economic structure was evolved on a terrain (central and western Europe) inherently more resistant to abuse than any other part of the earth's surface, and at a time when our engines for subjugating the soil were still too weak to ruin it. We have transplanted that structure to a new terrain, at least half of which is set on a hair-trigger of ecologic balance. We have invented engines of unprecedented coarseness and power, and placed them freely in the hands

of ignorant men. I do not regret this social experiment,—it is creation's most daring attempt to mitigate the rigors of tooth-and-claw evolution—but I assert we should be surprised, not that the pre-existing structure needs widening, but that it will serve at all.

One of the symptoms of inadequacy in our now existing structure is the perennial stalemate over the public domain. How can we keep it without a huge expansion of federal machinery? How can we give it away without the certainty of misuse? There is indeed scant choice between the horns of this dilemma. But would there be a dilemma if there were such a thing as *contingent* possession, or else a differential tax exerting a constant positive pressure in favor of good use?

This paper forecasts that conservation will ultimately boil down to rewarding the private landowner who conserves the public interest. It asserts the new premise that if he fails to do so, his neighbors must ultimately pay the bill. It pleads that our jurists and economists anticipate the need for workable vehicles to carry that reward. It challenges the efficacy of single-track land laws, and the economy of buying wrecks instead of preventing them. It advances all these things, not with any illusion that they are truth, but out of a profound conviction that the public is at last ready to do something about the land problem, and that we are offering it twenty competing answers instead of one. Perhaps the cerebration induced by a blanket challenge may still enable us to grasp our opportunity.

The early twentieth century is already significant for its tendencies toward all kinds of shortcuts. Not only do we have such legitimate shortening of time and space, as by the automobile, the aeroplane, and the radio; but we also have those questionable shortcuts to earthly "paradise," like the overthrowing of organized government by mobs in the desire to secure favors for the "outs;" rule by a minority group disregarding human nature, and promising a Utopia, and governmental "personal (?) liberty;" and the enactment of new laws with hopes, by some, of legislating honesty and creating wealth without labor.—Charles Meek, *Pa. Dept. Forests and Waters.*

GRASS, PINE SEEDLINGS AND GRAZING

By G. A. PEARSON

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Early studies of ponderosa pine reproduction in the Southwest emphasized the value of protection to young seedlings against sun, wind and cold. Shade by trees, grass, logs and other objects was thought to be beneficial, if not indispensable. Later, the idea was advanced that such benefits as are derived from cover operate mainly through soil improvement, and that shelter of the seedlings themselves is rarely needed or may be positively harmful. The information presented in this article supports the latter viewpoint.

EVIDENCE accumulated between 1908 and 1918 was mostly in favor of the protection theory.[1] Germination was universally better under some sort of cover than on bare soil exposed to the sun. Survival under cover was poor; but this was not considered significant, for did not the seedlings die every where? Of the few seedlings that survived the first winter and the following June drought, nearly all were destroyed by grazing animals or rodents, and so there was little opportunity to ascertain what other factors might figure in ultimate survival. An ungrazed experimental area on which the brush was scattered after logging in 1908, at first offered striking evidence that a brush cover favored pine reproduction; but after a year or two the difference between brush-covered and uncovered areas disappeared. However, a small area plowed and heavily seeded in 1914 gave better survival on brush-covered strips than elsewhere. Two other areas fenced against grazing animals accumulated in 10 years seedlings in numbers varying from practically none to over 200 per acre. Logging slash was not a factor, but it was observed that results were better on the sites of light grass cover than on bare soils or those occupied by luxuriant grass.

Abundant germination and survival in 1919 furnished an unusual opportunity to observe results under a variety of conditions. Studies during the period of 1919 to 1921[2] disclosed that the mere presence or absence of soil cover was less important than the character of this cover and the character of the soil itself. The significant findings are briefly summarized as follows (p. 137):

"Next to climate, soil is the most important physical factor. . . . Reproduction seems to be affected most by the physical condition of the soil, as determined by the proportion of sand or gravel which it contains. Where the soil is sandy or gravelly reproduction is seldom a matter of serious concern. Clay soils, on the other hand, are unfavorable to reproduction. Clay is rendered more favorable by the admixture of large proportions of gravel or stone." Elsewhere in the text, organic matter is given as an additional element contributing to the porosity and generally favorable condition of soils.

"Herbaceous vegetation favors germination and protects young seedlings against excessive insolation, winter killing, and frost heaving; but after the first year these benefits are counterbalanced by the unfavorable effects of root competition and

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[1]Reproduction of Western Yellow Pine in the Southwest. By G. A. Pearson, Dept. of Agr. Circ. 174, 1909.

[2]Natural Reproduction of Western Yellow Pine in the Southwest. By G. A. Pearson, Dept. of Agric. Bull. 1105, 1923.

shade. . . Reproduction will usually succeed despite competition from the roots of herbaceous plants, provided that the latter do not attain abnormal density or luxuriance. Such a condition is likely to obtain on the richest soils unless the grass and weeds are held in check. Complete eradication of herbaceous vegetation is not considered necessary, and is distinctly undesirable if accompanied by packing of the soil as in overgrazing, or removal of the loamy surface layer as in deep plowing. . . ."

The foregoing conclusions were based on extensive observations checked by numerous plots on which survival of seedlings was recorded at different seasons over a period of 3 years. The sites embraced different soils and types of grass and weed cover, both grazed and ungrazed; areas in the zone of tree shade and root activity, and similar areas from which the trees had been cut; areas covered by leaf litter and logging slash, and areas denuded of all cover by logging, fire, overgrazing and cultivation. The records were maintained for several years after the initial study was finished, and observations are still being continued. Additional information obtained from year to year has amplified or modified the conclusions, but nothing has been brought to light that would warrant changes of a radical nature.

1928 Experiment

Although the splendid stand of seedlings which started in 1919 suffered severely from browsing by sheep and cattle, there was, at the same time, much evidence in support of the opinion held by some foresters that the heavy grazing which prevailed before and for several years after germination aided the initial establishment of these seedlings by reducing grass competition. Grazing was lightened materially in 1926 and following years. Along with a decrease in damage to pine seedlings came a marked increase in height and density of bunch grasses, particularly Arizona fescue (*Festuca arizonica*). This gave rise to the fear that, in the effort to overcome the evils of overgrazing, the pendulum might swing too far in the opposite direction and thus hinder the establishment of additional seedlings.

In order to study this problem under controlled conditions, a series of experimental plots was laid out in 1928, within a fenced area (Sample Plot S 3 B) which had been closed to all grazing since 1910. An account of the progress of reproduction on this area has been given in a recent article.[3] Seedlings had started in 1919 at an average rate of 61,000 per acre. They were originally most numerous under immediately surrounding groups of seed trees, but survival proved very poor in these situations. In grass stands of moderate luxuriance, where mountain Muhlenbergia (*Muhlenbergia montana*), beardless bunch (*Blepharoneuron tricholepis*), or feather grass (*Andropogon scoparius*) predominate, both germination and survival were good, as evidenced by the fact that these sites are now well stocked. Where Arizona fescue predominates, seedlings during the first summer were as numerous as in the other grass associations, but practically all died within a few years. On heavily grazed areas of fescue outside the fence, however, there was better survival, despite grazing damage.

The 1928 plots were laid out in a nearly pure fescue association where seedlings were abundant in 1919 but failed later. Seven plots were included in the series. Two were left in their natural state; one was burned lightly before seeding, then left undisturbed; one was denuded by cutting the grass, below the root collar, leav-

[3]A Twenty-year Record of Changes in an Arizona Pine Forest. By G. A. Pearson. Ecology, July, 1933.

ing the ground surface undisturbed; and three were clipped to heights of 2, 6 and 10 inches, respectively. This clipping was repeated two or three times each summer, according to the rate of growth. Previous experience with rodents pointed to the necessity of excluding them. Accordingly, a rodent-proof fence was built around the plots. A parallel series was left unprotected.

In order to insure adequate and fairly uniform seeding, each plot of three square meters was sown with 600 pine seeds. Seeding was done in June before the summer rains began, and the soil was raked lightly wherever the cover permitted. Owing to deficient rainfall in the summer of 1928 no germination took place and, consequently, the plots were resown in 1929. Copious and well distributed showers through July and August of 1929 resulted in excellent germination. Table 1 gives a record of seedling counts on the various plots over a period of 5 years.

The records in 1929 show good germination on all the plots, even when rodents were not excluded. Variation in numbers in the first count is not regarded as significant because there may have been a difference in the holdover of seeds from the 1928 sowing and in the amount of natural seedfall of the previous year. Of course, rodent activity accounts for the much lower germination outside the exclosure and for a good share of the variation between plots in the unprotected series. Since, however, germination was adequate on all the plots, this study concerns itself primarily with survival. Because of the uncertain variable introduced by rodent activity, even after germination, only the rodent-protected plots will be considered in determining the effect of grass cover upon survival.

Abundant rainfall through the fall of 1929 prevented the heavy mortality which sometimes occurs during this season of the first year. Although the counts show a decline of over 50 per cent on some plots up to November 20, this amount of loss is considered less than normal, in the light of past experience. Activity of a root-cutting insect accounts for some of the deaths but most of them are unexplained. The soil was moist on the surface up to November 20, when observations for the season were discontinued.

Counts on May 29, 1930, revealed large losses on some of the plots. An earlier examination indicated that the loss had occurred during the winter months. Deficient soil moisture could scarcely have been a factor, but absence of snow in December created conditions favorable to winter killing. It was thought in the study of 1919 to 1921 that a cover of any kind would protect young seedlings against winter killing, but these records show that survival was best on the plots having least cover. Although it would be difficult to establish a direct relation between survival and height and density of grass cover, the high survival on the denuded plot and the 2-inch clipping is outstanding.

Another experiment conducted during the same period offers a suggestion. Pine seedlings in the nursery at Fort Valley were grown during the summer of 1929 in full sunlight, half shade, and about 90 per cent shade. In the spring of 1930 every seedling in 90 per cent shade was found to be dead. The evidence points to shade during the growing season of 1929 as being the adverse factor. It is to be expected that a plant shaded to the extent of retarding photosynthesis would suffer during a prolonged period of cold weather, because of low cell-sap concentration and deficient food storage. It is conceivable that a stand of grass 2 or 3 feet tall might be effective in bringing about such a condition. From the first season, the seedlings in the tall grass had the slender form of stem and needles characteristic of shade influence. Whatever may be the true explanation, the winter losses as shown by Table 1, were much greater on the plots covered by tall

TABLE 1

RECORD OF GERMINATION AND SURVIVAL OF PONDEROSA PINE SEEDLINGS ON GRASS PLOTS TREATED IN DIFFERENT WAYS

A. Protected Against Rodents

		Density[1] of grass		Number of live seedlings on different dates									Height of seedlings 8/18/33		
				1929			1930			1931	1932	1933			
Plot	Treatment of grass	A. f.	Others	Aug. 22	Oct. 25	Nov. 20	May 29	Aug. 6	Oct. 17	May 21	July 18	Aug. 18	Range	6 in. & over	10 in. & over
													Inches	No.	No.
1	Natural	.0823	.0033	309	181	151	28	6	6	1	1	1	5	0	0
2	Clipped to 10 in. (denuded 1932)	.0765	.0277	169	97	91	43	1	1	0	0	0		0	0
3	Burned 1928	.1259	.0376	332	279	271	91	23	17	15	10	8	2—6	1	0
4	Denuded 1928	—	—	382	378	374	288	148	136	109	100	71[3]	5—17	69	29
5	Clipped to 2 in.	.1681	.0226	258	224	219	116	30	29	16	11	11	2—10	2	1
6	Clipped to 6 in.	.1070	.0083	241	231	218	56	8	9	5	4	4	3—11	2	1
7	Natural	.1002	.0032	90	89	81	20	11	8	8	5	5	3—7	1	0

B. Unprotected Against Rodents

8	Natural	.1050	.0180	79	59	40	4	1	0						
9	Clipped to 10 in.	.0866	.0155	81	63	52	3	0							
10	Burned 1928	.0850	.0270	63	53	46	5	0							
11	Denuded 1928	—	—	122	99	97	62	17	15	5	2[2]	2	5—7	1	0
12	Clipped to 2 in.	.0895	.0121	138	87	72	25	7	1	1	0				
13	Clipped to 6 in.	.0943	.0043	65	55	39	10	4	2	0					
14	Natural	.1030	.0062	70	56	37	7	3	2	1	1	1	6	1	0

[1]Density of perennial grasses, referred to a complete cover represented by 1. Measurements 1 inch above the ground, June, 1928. A. f.—Arizona fescue.

[2]Both seedlings had their tops cut off by rodents in 1931.

[3]25 seedlings removed in 1932 as a thinning measure.

grass than on the denuded plot and the one clipped to 2 inches. The 6- and 10-inch clippings behaved more like the unclipped than the clipped plots. It would appear from these results that the injurious effects of shade begin during the first season instead of later as reported in the 1919-21 investigations.

The first serious loss came in the latter part of June and early July, 1930, as recorded in the August count of Table 1. Here again it was the grass plots that suffered most. The effect must be attributed mainly to drought resulting from root competition. Soil moisture determinations were not made in 1930 but they were in 1933, with results as shown in Table 2. The year 1929 had heavier summer rainfall than 1933, but autumn rainfall was similar, being above normal in both years.

A comparison of the seven plots in Table 2 brings out one relationship that is especially significant. At the beginning of the series of soil samplings on June 3, plant growth was just getting well under way; and all the plots had a good supply of moisture, the denuded plot No. 2 being below the average in this respect. As the dry period advanced through June to July 5, the grass-covered plots declined sharply, whereas the denuded plots declined but little, retaining a margin above the highest grass plot of 3.7 per cent at a depth of 4 to 6 inches and 4.4 per cent at 6 to 9 inches. Plot No. 4, which had been denuded in 1928, but now bears a dense stand of pine seedlings averaging a foot in height, behaved in essentially the same manner as the grass-covered plots. After the summer rains were well in progress (August 3), the grass plots replaced their earlier water loss, all surpassing the denuded plot at the 4- to 6-inch

TABLE 2

SOIL MOISTURE UNDER DIFFERENT CONDITIONS OF GROUND COVER (SAMPLE PLOT S 3 B, RODENTS EXCLUDED), 1933.

Depth of Sample 4 to 6 Inches

Plot No.	Treatment of grass	Soil moisture, based on dry weight					
		June 3	June 19	July 5	Aug. 3	Sept. 5	Oct. 20
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1	Natural	19.2	9.5	7.7	19.5	12.3	20.8
2	Denuded 1932	14.8	12.4	12.8	16.8	16.7	21.7
3	Natural (burned 1928)	15.9	10.2	7.4	20.1	12.4	21.4
4	Denuded 1928 Dense stand of pine seedlings 1933	16.1	11.6	8.8	13.2	11.8	17.1
5	Clipped to 2 in.	16.8	9.5	6.2	19.1	17.0	21.1
6	Clipped to 6 in.	13.7	10.2	7.1	23.0	15.6	21.9
7	Natural	17.7	13.3	9.1	23.2	21.1	22.6

Depth of Sample 6 to 9 Inches

Plot No.	Treatment of grass	June 3	June 19	July 5	Aug. 3	Sept. 5	Oct. 20
1	Natural	19.1	10.3	8.3	18.1	12.6	18.4
2	Denuded 1932	15.0	12.7	13.5	23.5	17.8	20.9
3	Natural (burned 1928)	16.4	9.2	8.4	18.6	13.5	19.9
4	Denuded 1928 Dense stand of pine seedlings 1933	17.5	11.1	10.8	13.8	12.0	17.0
5	Clipped to 2 in.	22.4	10.3	7.7	19.3	17.5	19.9
6	Clipped to 6 in.	17.0	10.8	8.1	23.9	16.8	21.5
7	Natural	19.3	13.7	9.1	21.3	17.4	21.1

depth. Plot No. 4, bearing the large 1929 pine seedlings, lagged behind the average of the grassy plots after July 5, indicating that the pine seedlings were consuming more water than the grasses. Throughout the entire growing season, the graph of the denuded plot No. 2 maintained a more even course than the graphs of plots bearing vegetation, whether grass or young pines. Its high position at the critical point on July 5 is especially significant, and explains why plot No. 4, denuded in 1928, lost so few pine seedlings in the dry season of 1930, as compared with the grassy plots.

A full explanation of all moisture changes and relations between plots throughout the season would add unduly to the length of this paper; but it is desirable to point out the major factors involved. The dependence of soil moisture upon rainfall is self evident. Evaporation is also important, though less far reaching than rainfall. Evaporation is rapid at the soil surface, but it decreases toward the lower levels, and virtually disappears at a depth of one foot. After the upper layer to a depth of several inches becomes air dry, further loss from this layer ceases until the supply is replenished by rainfall or otherwise. A mulch of dead litter or the shelter of vegetation retards the rate of evaporation. This explains, in part at least, the higher moisture content of the plant-covered plots than of the denuded plot on June 5. Finally, it should be understood that soil moisture determinations are not an accurate measure of the moisture content of the whole plot. Each sample represents only the particular spot on which it is taken, and the result may be different a foot distant. This element of error may account for minor fluctuations within a range of perhaps 2 per cent. Wilting coefficients have not been determined for this series; on a similar site nearby, determinations in 1920 gave values ranging from 9.8 to 10.7 at a depth of 9 inches.

Next to precipitation, the dominant factor affecting soil moisture is water consumption by plants. This overshadows all other factors in the relation between various plots of the present study. Direct evaporation from the soil is distinctly secondary, especially when soil layers a few inches beneath the surface are concerned. During the rainy period, extending from August to October, 1933, the denuded plot No. 2 was consistently lower than the grassy plots at a depth of 4 to 6 inches. The difference is due in large part to higher evaporation on the denuded plot; penetration may also have been less on the bare soil, due to more rapid runoff. Had samples been taken nearer the surface, the difference in favor of the grass-covered plots would have been still greater, as indicated by the observations that the top soil on these plots remained almost continuously wet, whereas the denuded soil dried off between showers. At a depth of 6 to 9 inches, however, the denuded plot was well up to the average of plots covered by grass, indicating that at this level evaporation had less influence than absorption by plant roots.

Clipping did not accomplish the saving in water consumption that might be expected from a reduction of leaf surface. Several factors combined to offset any favorable transpiration balance. In the first place, the grasses were clipped only once in the early summer, and thus there was an appreciable amount of green leaf surface during the dry period. According to Table 1, plot 5, clipped to 2 inches, had a greater grass density than any of the natural plots. The clipped plots were more exposed to evaporation than those covered by tall grass. Although all of the plots have a density below 0.2 as measured at the ground line, the spreading stems and leaves create almost a complete canopy save for occasional relatively large openings. Finally, and this may have been an important factor, the spaces between grass tufts on the clipped plots were invaded by a rather dense stand of spring annuals, mostly too

low to be affected by clipping. They were removed from the denuded plot but not from the others; on the natural plots they were little in evidence. All of these factors presumably operated in much the same way in 1930, and this explains why the June-July mortality of that year was practically as high on the clipped as on the natural plots.

A record of numbers and heights of seedlings on the various plots is given in Table 1. In the final checkup, the superiority of the denuded plot in both numbers and size is convincing. The 2-inch clipping, though far behind the denuded plot, holds a distinct lead over the unclipped plots. The 6-inch clipping is low in numbers, but it ranks with the 2-inch clipping in size of seedlings. No explanation can be offered for the complete failure, in 1930, of the plot clipped to 10 inches. Only one seedling on the three plots bearing tall grass measured up to 6 inches in 1933; none attained the 10-inch mark; and all showed the effects of shading. A near view of the denuded plot bearing 71 large seedlings, is presented in Figure 1.

A glance at the record of the plots open to rodents (Table 1) leaves little doubt as to the dominating influence of this factor. It should be borne in mind, however, that protection again grazing and predators has built up an abnormal population of meadow mice, and that the damage by these animals was undoubtedly greater than would be experienced in an area open to grazing. The damage was not confined to eating seeds, but went to the extent of biting off the tops of seedlings up to their third year. As late as August 6, 1930, after the close of the drought period of that year, survival on the various open plots was in complete accord with the relationship found within the rodent enclosure. Between this date and May 21, 1931, rodent damage was the major factor and it reduced the number of seedlings so greatly as to render the plots valueless for comparison of losses due to plant competition. The two seedlings in the denuded plot No. 11 were both injured by rodents in 1931. The lone survivor in all of the grass-covered plots outside the rodent exclosure is in an open space 18 inches in diameter.

In 1932 all the plots except No. 4, which was already fully stocked, were resown. Plot 2 was also denuded in the same manner as No. 4 had been in 1928. It developed that the rodent exclosure was no longer rodent proof because the seeds were eaten by rodents, as evidenced by the broken seed coats which littered the ground a week after seeding. Not one seedling was obtained. Needless to say, the same result was experienced outside the exclosure, except on a denuded space of about 2 x 4 feet which was covered by a special screen. This plot supported 85 seedlings in October, 1932; on January 3, 1933, there were 65;

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Fig. 1.—Plot No. 4 denuded in 1928 and sown in 1929 contains 71 seedlings, 29 of which are over 10 inches high. Plot No. 5, clipped to 2 inches, in immediate foreground, contains 11 seedlings, 2 of which are 10 inches or over. Plot No. 3 in background, lightly burned in 1928 but essentially natural, contains 8 seedlings ranging in height from 2 to 6 inches.

and on September 4, 51 remained. Another plot near by treated in the same manner contained 75 seedlings in October, 1932, and 32 on June 3, 1933. The screen was removed on July 5, at which time 24 live seedlings were counted. On September 4 every seedling was found to have been injured by rodents; 19 were reduced to mere stems, and only 5 retained any leaves. In July, 1933, a similar denuded plot was resown and screened; on August 18 it contained 60 seedlings. The results clearly show that on good soils little or no shade is needed to obtain germination, and also that small rodents may destroy seedlings a year old.

The foregoing findings are entirely in accord with experience in nursery practice in this region. Ponderosa pine seed beds are usually shaded in order to maintain the uniform surface moisture required to insure complete germination; but in normal rainy seasons satisfactory germination is obtained without shade. It has been demonstrated time and again that if shades are left on ponderosa pine beds through the second season, the seedlings develop a slender and weak form. No experienced nurseryman allows weeds to grow in seed beds, for he knows that if this takes place the seedlings are going to suffer. The findings are also in accord with long established practice in European forests where precautions are always taken to avoid the suppression of young conifers by dominating herbs and shrubs.

Interpretation of Results

Although the findings which have been presented are conclusive for the conditions described, they should be interpreted with full knowledge of other conditions which may be encountered. They establish a principle rather than a rule. Not all grasses grow so rank as to interfere seriously with pine production and not all soils will produce a tall, dense stand of grass. On the other hand, the richer soils, such as those found in stump patches, may bear weed growth capable of offering more competition than the most luxuriant grasses. The facts to be remembered are that ponderosa pine is intolerant of shade; that it does not need shelter in the form of overhead cover, even in the seedling stage; and that it needs a fairly sustained though not abundant moisture supply during the first few years of its life. Competing vegetation, if tall enough to overtop the seedlings, can easily produce too much shade; and plant growth of any kind competes for moisture. A limited amount of vegetation, though drawing water out of the soil, also aids in absorption of rainfall, and retards evaporation. It, therefore, becomes a question of preserving a favorable balance rather than complete removal of competition. How much ground vegetation, if any, is required to preserve this balance depends upon soil and topography. In the experiment here described, the soil has a high clay content; but it has been mellowed by 18 years' accumulation of organic matter, under complete protection from grazing. Similar conditions are found in greater degree on stump patches where leaf litter has rotted down for centuries. On such sites, if the soil is held in place, pine seedlings attain their maximum growth where competing vegetation is entirely eliminated. This also applies to sandy soils or other soils which absorb moisture readily and do not pack under grazing use or under the impact of rainfall. Whatever herbaceous vegetation may be needed on soils of this class is to hold them in place and retard runoff until a stand of seedlings can obtain a foothold. In fact, it is not essential from the stand-

point of pine reproduction that the soil have a high degree of stability, so long as it is deep and permeable, because ponderosa pine is a veritable weed which, under favorable conditions of climate and seed supply, takes possession of sites too sterile to support grass.

Whether herbaceous vegetation is detrimental, neutral or favorable to pine reproduction depends on its density and habits of growth, and upon the character of the soil. On this basis, the more common species or plant associations in the region of this study may be classified as follows:

Arizona fescue (*Festuca arizonica*)—This grass, where dominant, is distinctly unfavorable because it attains a height of from 24 to 30 inches, forms a dense ground cover, is active during the June and early July drought period, and under conservative stocking is more lightly grazed than most other forage plants. It attains its best development on soils that are rather too heavy for the best development of pine seedlings in the early stages. It should be heavily grazed, or removed by mechanical means in patches, to permit establishment of pine seedlings.

Mountain muhlenbergia (*Muhlenbergia montana*)—Though normally growing almost as tall as Arizona fescue, this grass is usually less dense, is more closely grazed, and thus creates less shade than the fescue. It remains practically dormant through the June-July drought period, thus tending to retard evaporation without competing seriously for moisture during this critical period. It commonly occurs on stony or gravelly soils that are naturally favorable to pine seedlings. If not too dense, it is favorable or at least neutral toward pine reproduction.

Blue grama (*Bouteloua gracilis*)—Ponderosa pine usually reproduces well on blue grama sites within the pine type. This grass is relatively short, makes little or no growth before the summer rains, and is grazed in preference to most other species. It, therefore, offers a minimum of competition for light and moisture, while providing a desirable soil cover on heavy soils.

Black sporobolus (*Sporobolus interruptus*)—This grass is commonly found on clay soils on which pine seedlings normally become established with great difficulty. It is short, except for the scattering flower stalks; because of its high palatability, it is cropped close to the ground wherever livestock graze; but it is one of the earliest grasses, and therefore competes for soil moisture during the early summer dry period. On the whole, its favorable influence probably outweighs any ill effects of root competition, because a cover is almost indispensable on the heavy soils which it frequents.

Mixed weeds—The weed growth which commonly succeeds grasses on overgrazed lands is for the most part beneficial to pine reproduction, because it seldom becomes tall and dense, and it provides more or less cover needed to hold the soil and retard runoff. On rich soils, such as occur on stump patches, however, weeds, if not closely grazed, often become so luxuriant as to suppress all pine seedlings.

Application in Grazing Practice

Control of herbaceous vegetation in the Southwest is necessarily associated with grazing. Grazing to the point of near denudation is, under most conditions, undesirable because it tends to pack and otherwise deteriorate the soil. Grazing Arizona fescue down to a height of 2 inches will not bring results equal to those of mechanical denudation, but it will aid materially, especially where the density is low and where spring annuals are eaten close to the ground. Grazing of such intensity over a long period is admittedly not good for a bunch grass range, but it is not necessary nor desirable from a forestry standpoint to continue heavy grazing indefinitely. A better course is to graze conservatively, as

a regular practice, until a good cone crop comes into evidence, then increase the intensity only for such time as required to save the seedlings from suppression. With a good seed crop in prospect, bunch grass areas of deficient reproduction should be grazed heavily, preferably by cattle. Where Arizona fescue is not present to any great extent, the grazing can be more moderate, but all vegetation should be grazed to such a degree that it will not form a dense and deep cover over continuous areas. Seedlings already present are likely to be injured under such treatment, but those over 2 years old can endure considerable browsing for a few years without serious consequences. Heavy grazing through the summer and early autumn in the year of seed development will discourage propagation of mice and will expose the ground for the reception of seed. (Poisoning of small rodents is to be recommended in this stage). The same beneficial effects will be realized from heavy grazing continued through the second year. Germination seldom takes place before the summer rains. In about 2 years out of 3, the rains will be found adequate for germination. If a good stand of seedlings is obtained, grazing should be directed toward encouraging their survival. Unless extreme overgrazing is practiced, few seedlings will be damaged the first year because stock do not habitually browse them in this stage. The second season, however, is critical, and damage should be held to a minimum because seedlings severely browsed at this age are more than likely to die. After their second year, pine seedlings withstand considerable browsing, and, within reasonable limits, the permanent loss from browsing is less than that resulting from unrestricted grass competition. By the time the seedlings are 5 or 6 years old they should have developed both roots and crowns that will enable them to compete successfully with grasses. Grazing should then be reduced or otherwise so regulated as to practically eliminate the browsing of terminals. Substantial height growth will follow and soon the seedlings will take their place in the sun.

Essentially the foregoing practice has been applied with gratifying results. In the Fort Valley experimental forest goodly numbers of 1928 and 1929 seedlings have become established under heavy cattle grazing followed by lighter grazing. It was the method unconsciously and crudely practiced on the Coconino and Tusayan in the years when the now famous 1919 stand of seedlings came into being. Failure on many areas to reduce the intensity of grazing at the right time prevented full realization of this rare opportunity to obtain complete stocking.

A program such as here outlined will encounter objection on the ground that the range livestock industry can not adjust itself to sudden fluctuations in the size of its herds. My plan does not contemplate violent changes in numbers over a whole national forest or other large unit, but a shifting of stock from one area to another in accordance with the requirements given above. The plan calls for conservative stocking of the forest range as a whole, and it calls for government control of water and other range improvements. In view of the fact that only relatively small areas need be involved at any one time, the administrative difficulties would not be unsurmountable. No doubt, some inconvenience and increased expense to grazing interests would be entailed, but this is justified and must be expected on lands whose chief value lies in timber production. Incidentally, it is well to bear in mind that on pine sites, accessible to market, and managed primarily for timber production, the annual timber increment has a stumpage value of 15 to 25 cents an acre, whereas the forage crop on the same area brings only about 1½ cents an acre. In a large proportion of the ponderosa pine type in the Southwest, grazing receipts by the Forest Service fall below the cost of

administration and range improvements provided by the government. During the next 2 decades an advancing tide of pine thickets will force millions of additional acres into this class. The time is not far distant when an economic livestock industry can not exist on well managed timber lands unless the needed range administration and improvements are furnished by the government at much less than actual cost. A certain amount of grazing in the forests is desirable for various reasons, such as fire protection, silvicultural benefits, and the support of local industry; but, if the government must pay out money to have its forests grazed, it should direct this grazing along a course that will be most useful to the forest.

I am not advocating a return to the old practice of continuous overgrazing; on the contrary, I believe that as a general thing the forest ranges, as well as other ranges in the Southwest, are still too heavily grazed. Pine seedlings are still being damaged too much in many places. After a forest has become well restocked, light and well distributed grazing is the proper course. During the reproductive stage, however, there are times for heavy as well as light grazing. On national forest lands whose primary crop is timber, grazing should be regarded as a part of silviculture; its main object should be silvicultural, and if the cost of carrying on grazing exceeds grazing revenue, the excess should be subject to silvicultural justification.

The houses are covered with shingles. The wood for this purpose is taken from the Cupressus thyoides, Linn. or a tree which Swedes here call the white juniper tree, and the English, the white cedar. Swamps and morasses formerly were full of them, but at present these trees are for the greatest part cut down, and no attempt has as yet been made to plant new ones.—PETER KALM, *Travels into North America* (an account of his visit to Philadelphia, 1748.)

OBSERVATIONS ON THE INFLUENCE OF FIRE ON THE BROWN-SPOT NEEDLE BLIGHT OF LONGLEAF PINE SEEDLINGS[1]

By PAUL V. SIGGERS[2]

How to control the brown-spot needle blight, is one of the pressing silvicultural problems in the longleaf pine region. The disease seriously retards rate of growth during the seedling stage, and under certain conditions may exterminate otherwise excellent reproduction. The author, after several years of painstaking investigation, during which he has systematically compared burned with unburned areas of similar character, confirms the recommendations of certain foresters that controlled winter burning at three-season intervals, until height growth begins, is a beneficial silvicultural measure.

A WIDESPREAD foliage disease caused by the fungus *Septoria acicola* (Thüm.) Sacc. occurs in varying severity on longleaf pine (*Pinus palustris*) throughout the southern states. The most conspicuous symptom of the needle blight on new spring foliage is the appearance of small spots which soon encircle the needles in the form of narrow brown bands with definite margins. This spotting has given the disease the name "brown-spot" (7).

One of the unusual features of the disease is that its virulence is confined to seedlings. It is most injurious to seedling foliage within 18 inches of the ground. When seedling growth carries the foliage above 18 inches, there is usually a marked decrease in the amount of the needle blight. The disease is capable of causing complete defoliation, leaving the stem denuded by the time new needles are ready to start growth in the spring. Complete defoliation when continued for several growing seasons greatly weakens the seedlings and finally results in death.

Usually longleaf seedlings, even on optimum sites, remain at or near the ground for the first three to five years of life. With favorable growing conditions during this period the young seedlings develop abundant foliage, increase their diameter growth, and form a strong root system. Not until they have gone through this period of development do the seedlings begin vigorous height growth. Under adverse growing conditions, young longleaf pines may remain near the ground for many years, occasionally up to 11 or 12 years. As the fungus attacks in the main that foliage below the 18-inch level, the slow early growth which keeps the plants below that height for years favors attack by the fungus.

The economic importance of the problem will be better understood when one considers that longleaf pine is one of the principal timber trees in the South and is able to grow and develop under conditions where no other native pine has as yet demonstrated the same capacity to produce a crop of timber.

Recognizing the injurious effect of the disease on the early growth of longleaf pine seedlings, a number of observers have advocated burning of young stands of longleaf in the dormant season, (2,

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[1]This paper has been prepared for the information of foresters and landowners interested in the establishment of natural longleaf reproduction. Much assistance in this work has been given by Mr. R. J. Riebold, Principal Forest Ranger, U. S. Forest Service, and Mr. A. F. Verrall, formerly Field Aid, Division of Forest Pathology, Bureau of Plant Industry, U. S. Department of Agriculture.

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3, 4, 5, 6). This treatment destroys the old needles, the principal source of infection for new foliage in the spring, which results in marked reduction in the amount of disease, sometimes for a considerable period. As a sanitary measure of disease control, the burning in winter of areas of young reproduction is made possible only by the wonderful resistance to fire damage possessed by longleaf seedlings during the period following their establishment and before vigorous height growth begins.

Method of Investigation

Assuming that fire retards the disease, its effect should be clearly seen during the following season and perhaps even for a longer period. To obtain specific information on the relation of the degree of infection to the number of seasons elapsing since fire, three surveys have been made in the longleaf region, one from Texas to South Carolina in 1931, the others from Louisiana to Georgia in 1932 and 1933. Another object of these surveys was to gain a better knowledge of the distribution and prevalence of the disease throughout the range of longleaf pine.

The following distinction is made between the terms locality and area as used in this discussion. Locality refers to the county or (in Louisiana) the parish where the investigation was conducted. By area is meant the territory within a locality where a specific fire occurred. The areas selected for study in a locality were usually not more than five or six miles apart.

From two to twenty-two (totaling 182) examinations of burned areas were made in each of 26 localities grouped among the following states as indicated by figures in parentheses; Texas (1); Louisiana (7); Mississippi (2); Alabama (2); Florida (9); Georgia (3); and South Carolina (2).

On these surveys, observations were made on the effect of a number of fires occurring previously in the same locality. Repeated annual examination of the same burned areas was the desired procedure. However, fires occurring after the first examination sometimes made further study of the effect of a single fire impossible. Some earlier work (8) on this same subject has been included, as it involved localities that were not examined in the extensive surveys.

In the field, for each seedling examined, the ratio of diseased or dead needle tissue to the total amount of foliage produced during the preceding growing season was estimated and expressed in percentages. Disease or normal defoliation eliminated needles of the seasons from consideration in these estimates. The average infection for any area was obtained by dividing the sum of percentages by the total number of seedlings examined.

In order to use these data, the areas of study were classified as areas of severe or mild infection, based on differences in virulence of the disease as determined in places where fire had not burned for a number of years. The values for seedling infection on areas having the same seasonal fire history were averaged and the curves in Figure 1 were drawn to fit the mean points of infection as determined for the first to the tenth season elapsing since fire.

Experimental Data

the distribution and varying severity of the disease

The brown-spot needle blight was present wherever longleaf pine occurred. The extensive surveys have revealed additional facts concerning its regional and local prevalence. First, disease incidence varied greatly in unburned areas in different localities. For example, the average amount of the disease on one area was found to be twenty times that on another area in a

different locality, although the elapsed period since fire was the same for both. Furthermore, disease incidence may occasionally vary considerably on unburned areas in the same locality. In Okaloosa County, Fla., two areas, 6 miles apart and both unburned for 8 seasons, were examined on the same day. On one, seedling infection averaged 3 per cent; on the other, 16 per cent.

There is a large region extending from near Lake City, Fla., through southeastern Georgia and South Carolina, where the disease is relatively mild, even on areas that have not been burned for a number of years. As pole stands have already taken possession of much of the longleaf site, the needle blight appears unimportant as a factor in the regeneration of longleaf pine in this territory.

RELATION OF THE DISEASE TO THE PERIOD ELAPSING SINCE FIRE

A study of the curves in Figure 1 indicates that a single fire greatly reduces the disease for the first season following the fire. The greatest proportionate increase in the disease occurs during the second season after fire. During the third season, the disease continues to increase on most areas. The sanitary effect of a single fire on the disease is of course lost after the lapse of several seasons. The writer believes that the effect of a single fire on the disease has nearly always disappeared by the fourth season after fire. The upward trend to the curves from the fourth to the fifth season is considered due to other causes. Apart from the effect of fire, the amount of the disease is influenced by variations in climate, seedling density, shading of foliage, height of foliage above ground, and season of the year.

Discussion

COMPARISON OF THE EFFECT OF EPIDEMIC DISEASE AND ANNUAL WINTER BURNING

An experiment has been carried on in southeastern Louisiana since April, 1929, to determine the detrimental effect of repeated annual defoliation induced by the disease under complete protection from fire. Graded and planted seedlings have been sprayed with Bordeaux Mixture or lime sulphur at frequent intervals and the growth of treated plants has been compared with that of untreated and diseased seedlings in adjacent rows. By the end of the fourth season in the field, the average height of 136 diseased seedlings was 1.8 inches, whereas the average height of 349 seedlings where the foliage had been protected by spraying was 10.8 inches. This test has clearly demonstrated that annual defoliation due to the brown-spot can greatly reduce the growth rate of small seedlings.

The stunting of longleaf seedlings in localities where annual winter burning is practiced is a matter of common observation. It can be ascribed partly to the yearly destruction of needles that (in the absence of the disease) would be retained at least until September of the following season.[3] A number of investigators have added to our knowledge of the effect of this practice upon longleaf reproduction. Wyman (10) reported the results obtained from annual winter burning, the first fire occurring when seedlings were about 15 months old. No mortality from fire oc-

[3]In the absence of the disease or fire, or occasional insect infestation, longleaf seedlings retain a given set of needles for a minimum period of 17 months, counting April as the first month and including August of the second growing season as the last month. Many observations on seedlings in the grass stage have shown that foliage in its second season is usually partially shed and occasionally entirely gone by the end of November.

curred until the majority of seedlings had reached 6 inches in height. At that time, when the seedlings were 7 years old, a fire occurring in January, 1921, killed 11.7 per cent of the seedlings on the plot burned annually. He found the rate of seedling growth seriously retarded by the frequent fires; average seedling height on the burned plot in September, 1921, was 11 inches, while on the unburned it averaged 21.6 inches.

PERIODIC BURNING AS A METHOD OF CONTROLLING THE BROWN-SPOT NEEDLE BLIGHT OF LONGLEAF PINE

Some evidence has been presented here dealing with the detrimental effect of fire on seedling growth *after* height growth has started. However, Cary has observed that fire may burn over an area of very small seedlings *before* height growth begins without checking subsequent development (1). This observation accords with the well-known capacity of this species to survive winter fires that occur before seedling height growth starts. This leads to the conclusion that periodic controlled burning may be employed to reduce the disease and thereby promote seedling height growth wherever the disease is general and severe. Chapman (2, 3), after studying the regeneration of longleaf pine on cut-over lands in La Salle Parish, La., reached this same opinion several years ago.

To test this conclusion, the writer, in August, 1933, measured the heights of 250 seedlings growing on an area that had been last burned over in March, 1931. For comparison, the same number of seedlings were measured on an unburned area nearby. Both areas had been planted in the winter of 1928-29 with graded longleaf seedlings raised in a nursery where frequent sprayings had held the needle blight in check. It is significant that the planting stock had been graded—a procedure that eliminated much of the variation in subsequent growth caused by initial differences in seedling vigor. Before planting, the entire area had been purposely burned to make the field work easier and reduce grass competition.

When a fire of incendiary origin swept over part of the plantation in March, 1931, the seedlings were three years old and therefore still very small. By the latter part of the summer of 1933, the average height of the seedlings on the burned area was 8.4 inches and where no fire had occurred it was 3.9 inches. Between the two lots of measured seedlings, no factor save the single fire was believed to have influenced seedling growth rate. The increase in seedling growth on the burned area must have been due in a large measure to a reduction in the brown-spot needle blight following the fire.

It is hoped that those interested in the development of specific areas of longleaf reproduction will find the following suggestions helpful in determining the importance of the disease for a given area.

Examinations should be made preferably in winter or early spring before new needle growth has started and in places where the disease has had at least two or three seasons' freedom from fire. Estimates should be based on not less than 75 to 100 seedlings that have started height growth sufficiently to lift their foliage just above the surrounding grass. Such seedlings usually suffer the greatest proportionate amount of needle infection.

In making estimates of the damage caused by the disease, one should be careful to include that portion of the foliage already completely killed. This may remain in place supported by the surrounding vegetation, but sometimes it has fallen off the stem. The dead parts of living needles are estimated as though the spots were crowded together towards the tips of the needles. The most useful estimate of the loss of functioning leaf tissue will indicate the ratio of the diseased or dead needles

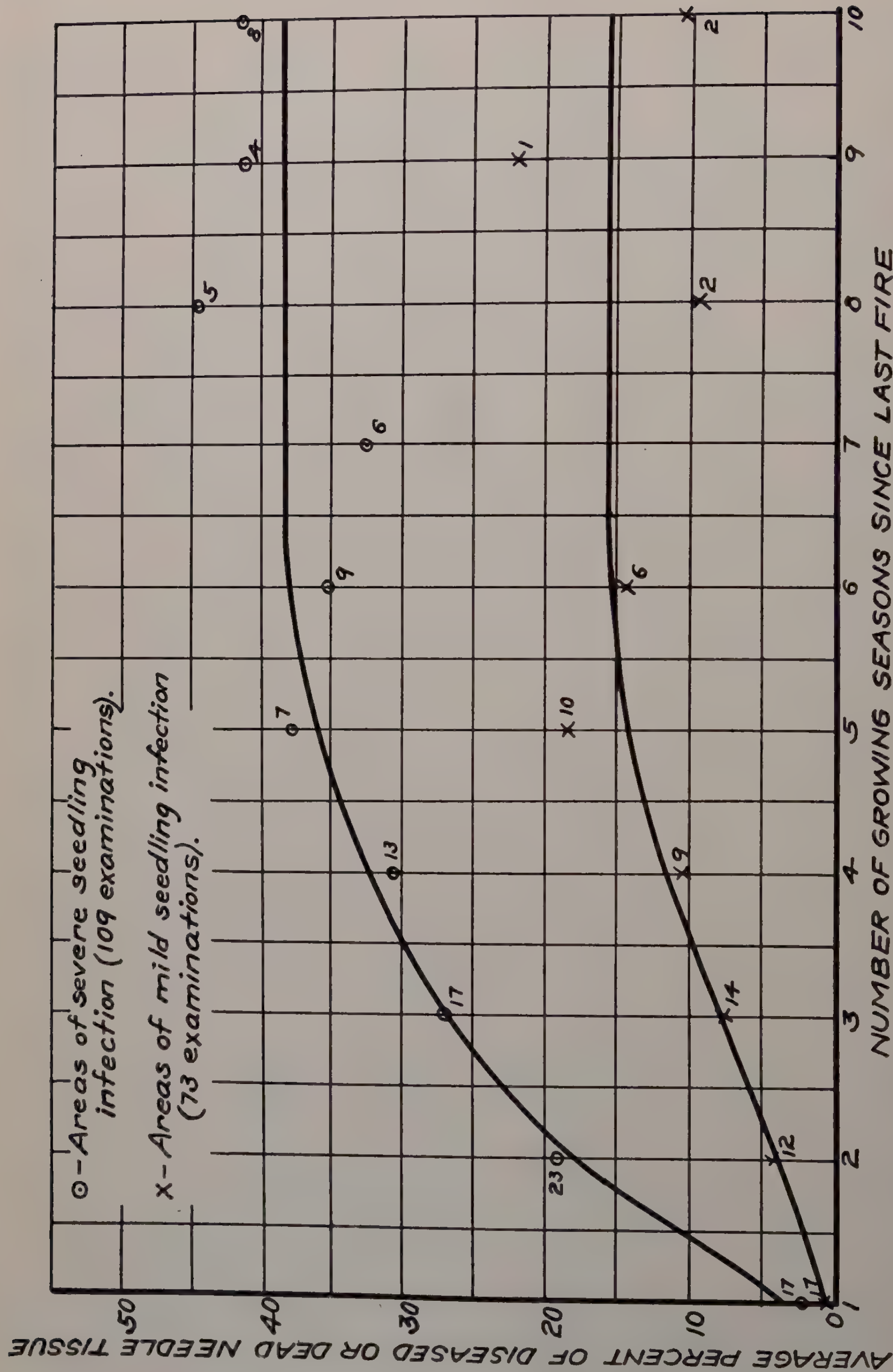

Fig. 1.—The relation of the degree of infection of the brown-spot needle blight to the number of growing seasons elapsing since fire.

to the total amount of foliage produced by the plant during the preceding season.

Where established seedlings have not yet started height growth and are heavily infected, a single controlled fire will reduce the disease for the first year and permit retention of foliage through the following season. This retention of foliage seems to give a well-established but disease-stunted seedling the stimulus needed to begin height growth (4, 5).

Most of this growth takes place so early in the growing season that it antedates development of spring foliage. The greater part of height growth is presumably dependent on the amount of food accumulated during the preceding season. Marked stimulation of height growth resulting from retention of the needles through a second season should not be looked for until the spring of the third season following the first fire. For this reason it is thought that controlled winter burning at three-season intervals will best serve to hold the disease in check and start vigorous height growth in backward longleaf reproduction.

It is understood that apart from the disease, other factors my restrict the use of fire on a given area; namely, the nature of the stand, density of stocking, size of the area, and the fire hazard. Fire, as a sanitary measure, has no place in a sapling stand, as even a light fire destroys foliage that would function during the next growing season. Consideration for adequate stocking may sometimes restrict the use of fire. In the natural regeneration of cut-over longleaf land, proper restocking calls for approximately a thousand well-established seedlings per acre. Where areas are definitely understocked, fire should not be considered, unless an adequate supply of seed trees exists. The size of the area to be burned should also be considered. Infection from unburned margins and from spots of incomplete combustion within burned areas plays a part in the recurrence of the disease. The cost of supervision, always a necessary charge with controlled burning, should not exceed the value of the reproduction involved. Ten acres is thought to be the minimum area to use for effective disease control.

The relationship between fire and the disease is only one phase of the fire problem. Fires do least damage when seedlings are dormant, but confining the burning to the winter months does not insure that fire will not harm the stand. Regard for other factors of fire hazard, such as character and age of the ground cover, air temperature, soil and fuel moisture, wind velocity, and relative humidity is just as essential as restriction of fire to the dormant season. A more detailed discussion on the use of fire in southern pine forests has been prepared by the Southern Forest Experiment Station (9). While the conditions that make burning "controlled" are fairly well understood, the technique of controlled burning is still imperfectly practiced. No specific set of rules concerning fire can ever be formulated to apply without modification to the wide range of conditions where longleaf occurs.

Summary

1. A widespread foliage disease known as the brown-spot needle blight occurs in varying severity on longleaf pine seedlings in the South.

2. It has been demonstrated experimentally that the disease can seriously retard the early growth rate of longleaf seedlings.

3. Observations have shown that a single fire greatly reduces the disease for the first season and often to a lesser extent for the second. This reduction in disease permits foliage retention through the second season, a condition necessary for optimum seedling development.

4. Once longleaf seedlings are established and before they emerge from the

grass, controlled winter burning at three-season intervals, until a sufficient number of seedlings start height growth, can be considered a useful silvicultural measure where the disease is serious on areas of longleaf reproduction set aside for growing timber.

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FOREST EDUCATION: THE ANXIOUS 4,000

By EMANUEL FRITZ

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The author argues that the dependence of forest production upon forest utilization is such a controlling factor in the future of forestry that the forest schools should train some of their students for the private forest industries as deliberately and adequately as they now train them for the public employ. He attempts to show, also, after discussing the factors that might increase or curtail the employment of forest school graduates, that there will be more forest graduates than the public services will absorb, thus offering another reason for diversifying forest education.

IN THE next 10 years American forest schools will graduate about 4,000 professional foresters. Under the present system of forest education, all but a few of the 4,000 will be trained and fitted primarily for the public services. An inadequately small proportion will be fitted for employment by the forest industries. The present condition might evidence an expectation that federal and state forestry will be vastly enlarged and a belief that the schools should continue to prepare their students principally for public jobs. It certainly gives proof of a lack of appreciation of the possibilities of the forest industries as a potential field for employment, the desirability of training men specifically for such industries, and particularly of the potentialities to forestry of having forest school graduates in private employ.

Some schools (12) aim obviously at training their students to pass the federal Junior Forester examination. They follow the Forest Service and this bureau has frequently shown an inclination to dictate the character of forest school training.

This article is intended to direct attention to the faulty structure we have set up and to the need of a changed attitude in our teaching objectives. It also attempts to answer the query "What will be done with the 4000 foresters who will graduate within the next 10 years?" raised in my earlier article (9) on forest education.

I may be properly accused of unfairness if I would not admit at the outset that there are several forest schools at which it is a tradition and a definite policy to prepare men for the lumber and related industries, notably Washington, and lately Michigan (1). One other large school (11) has more recently announced its intention to break from the traditional single program.

It is not safe to assume that the public agencies will always absorb the bulk of the annual crop of foresters. To be sure, we are just now experiencing a dearth of good men for the many forestry jobs created under the national relief and recovery programs and therefore there would appear to be nothing to worry about. But these programs are principally emergency measures and cannot be counted upon to continue. Therefore unless something happens to create more positions in the public services or to qualify more of our forestry graduates to handle other than public jobs, we will eventually experience a large surplus of professional foresters. It is not at all good for the future health of forestry that we continue to train our men primarily for public employ or to give them the impression that a public job is the acme of ambition. Nor is it wholesome for forestry that we seek more job-making laws, although a moderate expansion in some public forestry fields is highly desirable. Any activity that depends largely on public financial support has too precarious a future and requires too much of

its energy to fight for its own existence. If our present friendly administration is succeeded by one inclined to be unsympathetic toward continuing its programs, federal forestry is due for a painful setback; or, if our present huge spending programs compel future drastic economy, retrogression rather than growth can be expected. Activities depending too heavily upon public support are inclined also to develop stagnation. So far, our professional growth rings contain too much of the soft, weak "springwood," and too little of the strong, tough, enduring "summerwood." A growth into private industry as a supplement and complement to public enterprise would toughen the profession's sinew. We need it to pull forestry out of its present narrowness and to make it more broadly useful.

The forestry profession has all too few men in the private forest industries—too few Swift Berry's, Dick Colgan's, Fred Madigan's, E. T. Clark's, C. L. Billings's and others; and these few, honestly desirous of going the limit in forestry but checkmated by the obstacles, are often ridiculed and embarrassed by the unreasoning and often selfish exhortations of their brethren in public employ, who, more intent on developing their bureaus, take little or no interest in getting action to remove those obstacles. Of course, we should not look upon the forest industries as a sponge to soak up our surplus graduates, rather they should be regarded as cognate and alternate employment fields. A portion of our students should be as definitely trained for them as for public employ. This diversification of outlets for our graduates should prove to be of incalculable benefit to forestry and I can see where the industries themselves would gain materially. Forest education, so far, has been carrying most of its eggs in one basket. The forest industries, as much as anything else, need a more appropriately trained personnel. It is the forest school's job to give them the recruits for that personnel just as it is the engineering school's duty to give the steel industry engineers.

Let us look into some of the forces that affect forestry employment — first, those that operate to increase it: (1) The momentum of the present widespread public interest, aroused by the President's relief and recovery programs involving forestry, might increase future interest in and support of federal and state forestry above the past normal; it is likely also to demand more forestry of the private owner. (2) The C.C.C. program, which has so thoroughly proven its worth, is reasonably certain to be continued perenially for plugging unemployment gaps, its size and scope depending upon the gravity of the situation. This program might be expected to take up most if not all of the slack in the employment of jobless foresters. It will be a useful reservoir for good foresters for whom there are no immediate jobs and a proving ground for those of marginal talent and capacity. (3) An important possibility is the reacquisition by the public of those privately-owned forest lands that cannot pay their way. This would require many more men as appraisers, timber-sale specialists, scalers, etc., to say nothing of additional forest supervisors and staffs if the reacquisition requires the setup of additional national forest units. (4) The formation, in the East, of new national forests from old cutover forest land and abandoned farms will require technical forestry personnel. This activity is likely to be considerably enlarged, due to the President's interest in land economics. (5) The forestry profession is entering the period of frequent retirements that will make way for promotions and for new men. (6) The operation of Article X of the Lumber Code might create a demand for the best of our technically-trained foresters in private employ or as consultants and their assistants. This demand should be considerable if precautions in training, to be mentioned near the close of this article, are observed. (7)

The Tennessee Valley rehabilitation and development project has already begun to draw foresters to its staff. As the project gets under way there should be work for at least 50 foresters, perhaps more, on a permanent status. (8) The National Park Service, the state park departments, the Biological Survey, the Soil Erosion Service, other federal bureaus, and many local forestry and wild-life agencies are creating a demand which, in total, might gradually mount to a large figure before saturation is reached. (9) Pest control work, particularly blister rust, might prove to be so successful as to warrant permanent large-scale control work requiring many foresters as crew chiefs, spotters, inspectors, and the like.

The forces so far mentioned operate to absorb a large part of each year's crop of newly graduated foresters. What are the forces that oppose them? The most important are: (1) The possibility that the present orgy of public spending will be followed by a long period of drastic economy in which forestry, having had the lion's share of aid during the depression, might have to take the beggar's place in retrenchment. (2) The possibility of a flood of foresters being turned loose as the recovery programs are tapered off or abruptly terminated. Those thus released will have a deserved advantage over the current graduates. With the released foresters will be also a large number of able non-foresters who, as C.C.C. or N.R.A. foremen, have learned to do certain types of forestry work and to like the work well enough to want to remain in it. Some would make mighty good rangers and will be competitors of the new graduates. (3) The regular or permanent employees of the public forestry agencies, having learned during the depression the security of a public job, are not so likely hereafter to quit it for what might appear to be a more lucrative one in private employ. (4) It is not at all certain that C.C.C. work of the future will be in the woods; pressure might be exerted to devote the energy to non-forest work not requiring forestry-trained supervision. (5) In the case of reacquisition of private forest lands, in the case of the new park personnel, and in other fields that might develop new jobs, it is not at all necessary that all the new berths be filled by forest-school-trained men. Much of the work can be done equally well and in some cases better, by forest-trained woodsmen, by engineers, zoologists, natural science specialists, etc. Forestry cannot expect to land all the jobs for itself. (6) The private forest industries will be slow in taking up new forest school graduates as business improves, even though their old antagonism to college men is much weaker than it once was. They will naturally re-employ the experienced men laid off since 1929—and there is a large number of such. Furthermore, these industries are not convinced that the present type of forest school training is adapted to their needs.

It is quite likely that the forest schools will experience a considerable increase in their enrollments. All the publicity that forestry has received the past 30 years is resulting in greater and greater interest in the high schools while the present tremendous national interest is bound to give a further boost to enrollments. Our 4,000 might easily be much too conservative.

All in all, then, conditions seem to point to a surplus of forestry students. But it is not the surplus that I am concerned about, rather it is that the surplus will result from our one-sided preparation of only training for public service. A small surplus resulting from a better balanced educational scheme would not be serious. Having more than the required number, public and private employers would have a better chance to choose the type of men they need. Furthermore, the possibility of a surplus will force upon the students a greater incentive to excel. Some few graduates, of course, (33 per cent for the period 1900-1929; 16

per cent for the forestry boom years 1926-1929), will naturally drift into entirely strange fields, such as insurance, real estate, general business, and others.

Should the fondest dreams of the government-ownership or regulation enthusiasts be realized and future timber land management thus be taken out of private hands the necessity for training men for the forest industries is not changed one whit, because the government should then be more genuinely interested than ever in forest utilization to justify the greater public ownership. It would apply as emphatically also to the training of those men who want to remain in public employ as forest managers, for, to use the words of my colleague, Professor M. E. Krueger, "If the trend toward government regulation or even ownership continues, we come back very strongly to your main thesis, namely, that foresters should have more accurate knowledge of harvesting, manufacturing and selling the crop, otherwise their regulation is likely to be unjust or their management wasteful."

According to Graves and Guise (10, Table 2, page 36) only 14 per cent[1] of the graduates of 1900-1929 found employment in forest utilization—logging, manufacturing, distribution, seasoning, and preservation, and 53 per cent of the total number graduated, went into forest administration, management, education, research, etc. Those who found their way into private industry did so largely because of their own inclinations, or because of family connections, or because they so directed their experience while in public employ that their services were demanded by private business. In all too few cases have these men gotten private jobs because employers felt their forest school training was an asset.

S. T. Dana (1), addressing the wood-using industries, felt that they "are coming to realize that technical knowledge is not only a desirable but an essential factor in enabling them to hold their own in the keen competition of the modern industrial world." He said further "*The marketing and manufacture of forest products are as much the concern of the forester as is their production.*[2] Forest schools must, therefore, turn out wood technologists who can function as investigators, technicians, and executives in the wood-using industries in the same way that silviculturists function in similar capacities in timber growing." Since Dean Dana was addressing wood-using industry representatives only, he, of course, had to emphasize wood technology. Forestry is even more dependent on the success of the primary industries of logging and sawmilling, on the intelligent and successful marketing of lumber and on the removal of the obstacles to private forestry. Graves and Guise (10) have not developed adequately what it would mean to the future of forestry to have more forest school graduates in the forest industries and of installing curricula to train these men specifically for their jobs, although they do show a fine understanding of the place of utilization in forestry. To quote from their page 4: "In managing timber resources, the task of forestry does not stop with the growing of trees and their replacement after cutting. It includes also the economical and efficient use of wood products. *The manufacture, distribution, and use of wood products are intimately related to the growing of the raw materials.*[2] This statement does not

[1]The questionnaires returned from graduates of forest schools of all classes from 1900 to 1929 show that 67 per cent remained in forestry. Of this 67 per cent, 21 per cent (or 14 per cent of the total) were found to be in forest utilization and the remainder, 79 per cent, in forest administration, management, education, research, etc. For the classes 1926 to 1929 the questionnaires indicated that 84 per cent remained in forestry. Of this number 19.3 per cent (or 16.2 per cent of the total) were in forest utilization.

[2]The italics are mine. E. F.

mean that logging, lumber manufacture, and merchandising of forest products, taken by themselves, constitute forestry. These activities become an important feature of the forestry enterprise only when they are correlated with and contribute to the conservation of the forests on which their permanence depends. Conversely, silviculture can be carried on successfully only when correlated with industrial and economic requirements." And from page 164: "The importance of forest utilization as a branch of forestry in education and in practice cannot be overemphasized. Aside from the general protective benefits of standing forests, *the chief objective of forestry is to produce materials of practical utility.*[3] This objective should never be lost sight of by the forester. It governs the work of silviculture and protection, it furnishes the justification for the whole forestry undertaking as applied to timber production."

The forest industries admit that much of the course work given at forest schools is useful in private work but feel at the same time that emphasis is laid too narrowly and heavily upon pure forest production based upon European standards, that the graduates have no conception of the problems of a private owner of timberland and that some still have an adverse and superior attitude toward private owners and operators. The forest industries, on their part, however have never been cognizant of their own responsibility toward the schools and toward the training of their own employees. Very few lumbermen take an interest in the work of the forest schools and it is even more rare to find one who is willing to set up a simple, planned apprenticeship through which the new college graduate can be put. None know better than the teachers themselves that the college graduate is not worth much to an employer during his first years and that the practical aspect of his training must be gained outside the college walls. A little interest and understanding should pay handsome dividends to the employers in the form of able future executives. Even the U. S. Forest Service, in spite of the fact that most of our graduates are trained specifically for its employ, sees the need of supplementing the theory, principles and fundamental facts of the college course with a practical training in applying these to its own work.

Rather than repeat here more of the arguments in support of training men for the forest industries the reader is referred to the articles listed at the end of this paper, particularly (2), (5), and (7). I will add only, in closing, that the forestry profession has harmed only itself in its past hostility toward the lumber industry, in its narrow conception of the field and function of forestry, and in its obstinacy in resisting the demands of its inarticulate undergraduates. We need a definite, deliberate, and intelligent curriculum in every important forest school, where one does not now exist, for the training of men for the forest industries, particularly lumbering—not vocational training but a thorough grounding in the fundamentals of the industries. With it must go fair and intelligent programs of winning the confidence of the industries and of getting them to accept our graduates and put them through apprenticeships comparable to those of other industries. However, we shall not get these programs until the old-school ignorance of the place of utilization in forestry and what still remains of our animosity toward lumbermen are removed, nor until we go to the lumbermen and find out what is needed. It is not enough to give the student who wants to enter the lumber business an idea of what wood looks like under a microscope or how a band saw works. He needs

[3]The italics are mine. E. F.

more thorough training in such things as lumber grades and their separate utilities; a better knowledge of the marketing of lumber and its problems; and an understanding of the financing and management of a timber owning and lumber-manufacturing concern. Of course, he must have a keen appreciation of the relation of a productive forest to a permanent industry. He should be as well prepared at school for a future executive job in a lumber company as engineer, banker, and commerce students are trained for their respective fields. Certainly he should be as well prepared for private work as he is now for public work. Public forestry alone is only a part of the picture and probably, as far as future supplies of lumber go, the least important part when we consider who owns the really economically productive forest land. Public forestry is also the most expensive forestry.

At this writing, Article X of the Lumber Code shows great promise as a catalytic agent for bringing foresters and lumbermen together and as the impersonal Moses to lead forestry from the platform into the woods. Article X offers foresters not only great opportunities but it also places responsibilities upon them that differ much from those to which the profession has become accustomed. Not the least of these is the improved training of foresters. As a prominent member of the Society of American Foresters recently put it: "Men trained simply in the theory of forestry for the public good and who are imbued with the idea that it is a calling more akin to religious missionary work will not be the kind of men that will be found useful."

To sum up, we need first of all to jettison our antipathies toward the private ownership and operation of timber; second, to acknowledge the obvious fact that forestry cannot exist without forest industries; third, to realize that it is our duty to offer training in forest utilization and marketing comparable in scope and calibre to that now offered in forest production.

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THE EFFECT OF CULTIVATING YOUNG BLACK LOCUST

By H. G. MEGINNIS

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IT is sometimes suggested that black locust plantations be cultivated during the first and second growing seasons, but seldom is such treatment considered essential to satisfactory growth and survival. Gaskill[1], as early as 1906, described the growing of black locust in Hungary and pointed out that bushes rather than trees were produced in that country by failure to cultivate the young plantations. The erosion control planting studies of the Southern Forest Experiment Station have shown repeatedly that black locust planted on unplowed, grassy areas adjacent to gullies suffer a greater mortality and show less rapid growth than those planted on less fertile but raw gully slopes. Splendid growth and survival are obtained if the former sites are plowed prior to planting.

During late May, 1933, some cultivation tests were made on black locust (from 1-0 stock) planted about six weeks previously on plowed, eroded land near Holly Springs, Marshall County, Mississippi. About 475 trees were cultivated and the same number in adjacent rows left uncultivated as controls. The trees selected for the tests included several grades of stock planted on a variety of sites, the latter, however, being uniform between cultivated and check rows. Cultivation consisted of either plowing two furrows with a small turning plow on each side of a row or hoeing to a distance of about 18 inches around each tree.

By the following July, the results of a single cultivation were so strikingly apparent in the color of the foliage, size of the leaves, and stimulated growth that detailed measurements were made on cultivated and check trees (Figure 1). Cultivated and check rows were selected at random and the first five trees on each measured. Lengths of the new terminal shoots were measured, leaves were counted, and the total leaf area determined[2]. The data are summarized in Table 1.

As shown in the averages and grand totals, cultivated trees had more than twice as many leaflets as did the checks and what is more important a total leaf area more than four times greater. This increased capacity for photosynthesis was reflected in height growth, the cultivated trees having produced new terminal shoots which averaged 12.7 inches in length, as compared with the leaders produced by the controls, which averaged only 3.1 inches.

The cultivated trees in each of the five groups greatly excelled the uncultivated check trees in both leaf production and new growth. Furthermore, an examination of the data for paired trees (from which the data in Table 1 were compiled) shows that 24 out of 25 cultivated trees had leaf areas from 2 to 35 times greater than on the check trees immediately adjacent. Only two cultivated trees had grown less in height than the paired checks. In the other 23 instances, terminal shoots from cultivated trees were 2 to 18 times greater

[1]Growing Locust in Hungary, by Alfred Gaskill. For. Quar. 4:106-111. June, 1906.

[2]Total leaf area was taken as equivalent to the total number of leaflets x area of average leaflet. The latter was determined by substituting the length and width of the average leaflet for L and W in the formula for area of an elipse (.7854 L x W).

in length than those produced by the respective checks.

At the same time there seemed to be an apparent relation between cultivation and the prevalence of leaf miner damage. This insect, principally the digitate miner (*Parecopta robiniella*), is far more of a pest than is commonly supposed and during the late summer droughts of 1932 and 1933, it caused almost complete defoliation of many planted and native black locust in the vicinity. Its depredations are most noticeable on slow growing trees and during dry periods.

Above: Vigorous young trees the growth of which was stimulated by breaking the sod and stirring the soil with a hoe.

Below: Appearance of two plowed rows contrasted with the untreated row immediately to the left of the measuring rod (scale in feet).

Fig. 1.—Result of cultivating young black locust a single time.

The greater prevalence of miner-damaged leaves on uncultivated trees was very noticeable and is reflected in leaf counts made on the trees mentioned above. Although the 25 check trees had less than half as many leaves as those cultivated, they had 2.6 times as many instances of insect infestation. Only seven per cent of the leaves of the 25 cultivated trees were insect damaged, as compared with 38 per cent of the leaves of check trees. Although no final explanation can be given as to why damage from this insect should be most abundant on uncultivated trees, the above findings are in line with the fact that less than five per cent of the leaves of cultivated black locust seedlings growing vigorously in a nearby nursery were damaged by the miner, whereas practically all native and planted trees in the vicinity were heavily infested.

Examinations made in October, 1933, at the end of the first growing season, revealed that cultivated trees were 17 per cent higher on the average than uncultivated trees, although all were approximately the same height when planted in the spring. Six cultivated trees (out of 311) had died as compared with 17 of the checks (also 311 trees). Had the controls not been planted on plowed sites, the mortality would surely have been much greater. Cultivation not only increased height growth, but greatly stimulated the production of vigorous lateral branches, which resulted in well-formed crowns quite in contrast with the slender whip-like leaders produced by the trees left uncultivated. Furthermore, the cultivated trees retained their foliage fully three weeks after all leaves had dropped from the check trees.

Cost records kept in connection with the above tests indicate that roughly 35-man

hours of hand labor were required to cultivate an acre of plantation,[3] whereas an equal area could be plowed in about 4½-man hours. At the prevailing local wage for field labor, or rental for mule and plow, the cost of hand cultivation was approximately \$4.38 per acre, as compared with only \$1.13 for plowing.

TABLE 1

COMPARATIVE LEAF PRODUCTION AND TERMINAL GROWTH OF CULTIVATED AND UNTREATED YOUNG BLACK LOCUST 55 DAYS AFTER A SINGLE CULTIVATION

	Total number of leaflets		Total area of leaflets		New growth: total length of the terminal shoots	
Group[1]	Cultivated	Checks	Cultivated	Checks	Cultivated	Checks
1	16,677	8,500	12,280	3,378	43.6	22.0
2	5,559	2,074	2,958	469	41.0	5.4
3	3,400	1,292	2,750	287	128.2	22.5
4[2]	4,862	2,924	2,857	929	56.9	16.4
5	6,528	3,145	3,657	743	47.7	10.2
Grand total (25 trees)	37,026	17,935	24,502	5,806	317.4	76.5
Average (25 trees)	1,481	717	980	232	12.7	3.1

[1]Each group consists of the first 5 trees in a cultivated row and 5 trees in the adjacent check row.
[2]Trees planted on unplowed sites 1932. Trees in other groups planted in 1933 on plowed sites.

[3]Spacing 6 x 6 feet (1,210 trees per acre).

INDUSTRIAL FORESTRY CARRIES ON

By W. L. GOOCH

Forester, The Chesapeake Corporation

This article discusses the forest management plans that a pulp and paper company in eastern Virginia is working out for its forest land holdings of 38,000 acres. The timber types are loblolly and scrub pine. While the work has been in progress but one year, the writer shows that foundations are being laid for a well rounded forestry project with sustained production of pine pulpwood the object in view.

THE road travelled by the industrial forester these past few years of financial bad weather has like that of our proverbial moral transgressor, been at times hard. But thanks to Mr. Roosevelt's country wide C.C.C. programme the unemployment slack among the brethren has been largely taken up—more fortunate are we than many other professional groups. While the man holding an industrial forestry assignment in the pre '29 days, when the income curve of business reached its peak, may not have been looked upon by his employer as exactly a financial luxury yet to this same employer this man and the field he represents is now quite likely to be considered as belonging to the luxury class. And for the reason that because of the nature of his work the forester's contribution to lower production costs is not generally direct or immediate.

In the pulp and paper industry the effects of the continued business depression have been severe, due in large part to over expansion in mill construction during the '20s. Glutted markets with resulting low prices have forced many of the high cost mills to suspend operations, leaving the manufacturing field to the more modern mills of large capacity and comparative low operating cost.

Particularly in the forestry staffs of the larger land owning paper companies has retrenchment in personnel been felt most keenly. A number of such companies in Canada, in New England, New York State and further west have been forced to reduce their forestry organizations to a few key men or to abandon it for the time being entirely. This dislocation of forestry activity among pulp and paper concerns has been more marked in the northern states than in the south.

One of the important southern paper companies that has recently come into the industrial forestry picture is The Chesapeake Corporation of West Point, Va.,—forty miles northeast of Richmond—manufacturers of kraft pulp, board and paper. This company, possessing one of the most modern and efficient kraft paper and board manufacturing plants, has been operating throughout this depression period continuously and profitably. Consumption of pine pulpwood by the sulphate process in the making of kraft pulp has been stepped up considerably since 1929, when a 240 inch paper making machine was installed. Today the battery of digesters necessary for pulp production for this single machine of 250 ton daily capacity requires upwards of 300 to 350 cords of pine wood, and stumpage equivalent of about 35 acres of pine forest each twenty-four hours.

Since about 1922 the company has been acquiring in fee in the counties adjacent to West Point, tracts—small and large—of merchantable pine timber. At this time these forest land holding approximate 38,000 acres. These properties were selected on the basis of good quality pine timber, large cordage per acre and were purchased at a price that would bring the stumpage cost of the timber, after allowing for carry-

ing charges to a figure not to exceed $2.00 per cord. A number of these tracts when cut over-run the original stumpage estimate on which the purchase price was based, thus bringing the stumpage cost to a figure less than $2.00. For a number of years the bulk of the company's pulpwood requirements came from these company owned timber tracts. Of late years, however, wood buying policy has turned toward purchases from farmers and other small land owners, with less dependence on company tracts. Today practically all pulpwood is delivered by truck either to the mill at West Point or to landings on nearby rivers and originates on lands not owned by the company. The purchase of pulpwood from country people these past several years has been a Godsend and at the same time company forest lands have had a resting period, desirable for assimilation and forest planning.

The particular responsibility of this company's forestry department embraces supervision of cutting methods in existing timber stands on company tracts, to provide for a replacement forest of pine on areas cut-over, fire protection in coöperation with the state forestry department, and to encourage by precept and example improved forestry practice on all forest lands—farmer owned and otherwise—within the pulpwood operating sphere of the company.

The initial effort of the forestry department has been a fact-finding survey of the company owned properties. Representing as they do a variety of land and timber conditions—cultivated land, old fields, marsh, forest land (cut-over, hardwoods, pine, etc.) an inventory is necessary for intelligent forest planning. For each tract examined there has been constructed a detailed land and timber type base map with stand table. Superimposed on this base map is a cover map showing all company activities since date of purchase, including areas cut-over by years, character of wood product cut—ties, saw logs as well as pine, or other, pulpwood—seed trees and their location, pine reproduction figures etc. Accompanying each tract map is a report on the property covering the forest history, tax, fire, logging and improvement record by years, information on neighbors, recommendations on future management, etc. On maps photographs (1½" x 2½") showing field conditions have been used to good advantage. Where pictures have been taken, direction stakes in field have been placed to facilitate comparison in future years. Some 7,000 acres of company lands have been examined to date—several more years will be required to complete the job.

As a help in answering silvicultural and research problems peculiar to this locality a number of experimental plots have been laid out. One such problem, dictated by manufacturing requirements, is the elimination in future pine restocking of the scrub or spruce pine (*P. virginia*). In the chemical cooking of this wood for pulp the knots resist disintegration, making necessary a screening out of these knots and a recook of them—expensive treatment. Loblolly pine (*P. taeda*) on the other hand is uniform in its digestion. These two species occur associated together and their silvicultural control is not always easy. Scrub pine is quite the equal of loblolly pine as a natural seeder. Plots deal with other management problems such as minimum number and distribution of seed trees, perparation of ground under seed trees for effective reseeding, controlled burning of cut-over land to better stimulate restocking, broadcasting of pine seed and girdling of hardwoods.

Progress has been made in fire protection. During the past summer the company purchased from the Aermotor Company, Chicago, Ill., four 100 ft. steel inside stairway fire towers. These were erected by the men in a nearby C.C.C. camp and have recently been turned over to the state forestry department for operation and maintenance. These towers have been

located to tie in with state and federal owned towers, and the portion of Tidewater Virginia lying between the James and Rappahannock Rivers is now covered adequately by look out towers. That these company towers may be better served when fire emergencies are reported, the company contemplates the purchase of a specially designed forest fire truck with water tank, pump, tools, etc., the same to be housed at plant and manned by a selected crew of yard employees. In this connection mention should be made of the excellent work being carried on by the men of C.C.C. Camp No. 72 in fire lane construction. Under the direction of state fire wardens these men have cleaned many of the old roadways traversing the forest lands in this section and have thus created effective fire barriers which if properly maintained in the year ahead will be most valuable in protecting from fire damage the young pine now coming in.

This past fall some 1,400 bushels of loblolly pine cones have been collected and properly stored. Plans are now under way for putting in a million loblolly seedlings for planting on company lands that have been cut-over three years or longer and which, because of hardwood competition and lack of natural pine seedling, will require planting to restore pine to the land. It is on this sort of "hospital" land that greater experimental use will be made of pine seed broadcasting. While the experience of other southern foresters in this field may differ, we have had fairly good success in broadcasting loblolly pine seed. Some form of ground preparation is essential—harrowing or disking—and also covering of the seed. Admittedly there is waste of seed, but if ground preparation can be kept to a nominal cost, not to exceed 75c. per acre, and if the work done early in the spring so that seedlings may enter their first winter with a maximum of height growth, both the costs and results of this method will stand favorable comparison with planting.

To take advantage of the time before our own nursery stock becomes available, we plan to purchase from the state forest nursery the coming spring 150,000 loblolly pine seedlings—more if obtainable. Many of these trees will be planted on "sassafras" fields. Whether from a toxic effect on the soil or not, it is true that sassafras bushes in open fields have a forbidding or uninviting influence on the natural reseeding ability of pine in these fields. Planted pine will thrive.

The foregoing comment touches the high points of the first year's work on The Chesapeake Corporation properties. To foresters and landowners elsewhere interested in like problems we extend a coöperative hand.

CHUTE LOGGING IN NEW YORK

By NELSON C. BROWN
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CHUTES have recently been revived as an economical method of transporting logs down steep slopes under several different conditions in New York, notably with some of the smaller forms of forest products. With the logging of less accessible timber in rugged topography, it is believed that chutes may be efficiently employed more frequently. Although chutes are used principally as a secondary method of log transportation in some sections of the country, they have been recently adopted for major use under special conditions in New York. Idaho has been for many years the center of chute operation in this country. Although they have been used to a limited extent for many years in the mountainous sections of the East, Northeast, and Southern Appalachians, they have been revived for certain specialized conditions in New York and none are of the type used in Idaho. Chutes are especially applicable to steep slopes and generally for short distances where road construction and operation by motor truck or sled transportation would be impractical. Chutes as used in New York are especially adapted for use in transporting small or medium size forest products, such as sawlogs averaging 10 to 20 logs per m.b.f., pulpwood in long or short lengths, fuelwood, cross-ties, chemical wood, poles and posts.

There are four distince types of chutes used in New York, each one applicable to certain specialized conditions of topography and forest product, as follows:

(1) The Tryon portable chute used for transporting fuelwood in the Hudson Highlands, constructed in $10\frac{1}{2}$-foot metal sections.[1]

(2) The Sykes portable plank chute used in transporting hardwood sawlogs.

(3) Earthen chutes used in transporting hardwood sawlogs in the woodlots of the Northern hardwoods, in the steep topography of the Central New York region.

(4) Pulpwood pole chutes operated in spruce stands on the steeper slopes of the Adirondacks.

Thus two of these chutes are of the portable variety, one of wood and one of metal. Two are devoted almost exclusively to hardwood sawlogs; two are devoted exclusively to small products, i.e., the Tryon chute for fuelwood and the pulpwood chute for 4-foot bolts. These chutes are of the gravity type; the only trail chute being used is the Sykes chute. All forms of chutes may be operated both in the winter and summer except the earthen chutes. However, all operate much more efficiently and economically during the winter when the frictional resistance is minimized during freezing temperatures.

The three types not already described in the JOURNAL OF FORESTRY are as follows:

(1) The Sykes chute was developed in Pennsylvania and has been used in the Adirondacks for more than 25 years. This is a portable chute made of board planks

[1] A Portable Cordwood Chute. By H. H. Tryon, Jour. of For., Dec. 1932.

in eight foot sections as illustrated in the accompanying diagram. The sections are generally laid directly along the ground on 3 x 4-inch cross-ties placed at the section joints. The chute is adapted to relatively level or gently sloping topography, as contrasted with the other three types used in New York. This chute is made in sections in the sawmill, generally from small and defective logs producing low grade lumber of maple and birch. Logs are horse skidded to the chute from distances up to 500 ft.; the chute is operated generally for distances up to ¾ mile and in extreme cases up to one and a half miles or more. Chute sections are laid in the fall before snow falls, and generally cost from $30 to $50 per mile to lay; they are laid on favorable grades of 1 to 4 per cent and occasionally on adverse grades. There are generally 15 to 50 logs in a string, averaging 10 to 20 logs per m.b.f., and making 1,000 to 2,000 b.f. or from three to five times the load transported with direct horse skidding. Logs are held together in the string by chain dogs when the motive power is exerted on the front log, otherwise they are pushed from a J or L hook attached to the end log. Chutes are used during both summer and winter, but are much less expensive to operate during freezing temperatures. Oils and grease are used in summer to facilitate the progress of the logs. Tractive power is furnished by a team, one horse walking on each side of the slide. The logs are delivered to a landing at the railroad.

(2) Earthen chutes have been used for more than 30 years in logging the steeper slopes of the larger woodlots in Central New York. Recently this practice has been actively revived. The chute is constructed by dragging two or three 16-foot logs of 14 to 18-inch top diameters on a practically straight line through the soft earth, preferably after a rain. This work is supplemented by men working with shovels and crowbars to remove rocks and other obstructions both before and after the dragging process. These logs make a semi-circular trough or channel through the lower places or declivities in the woods along which the logs are banked after skidding. Straight lines are necessary as they are always operated as gravity chutes, the channels are generally shallow and the speed of the logs is exceedlingly rapid. Stream beds in gulches are always avoided because they tend to be rocky. These chutes are generally from 500 to 600 feet in length, but may be constructed for a minimum length of 200 feet. They have also been used for lengths of 700 feet or more. About 50 to 70 m.b.f. or more, of hard-

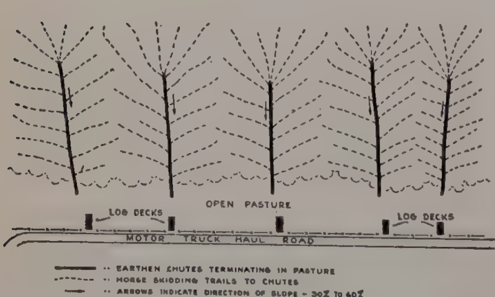

Fig. 1.—Sketch illustrating use of earthen chutes in logging steep hardwood slopes in central New York. When frozen these chutes operate most efficiently. Not drawn to scale.

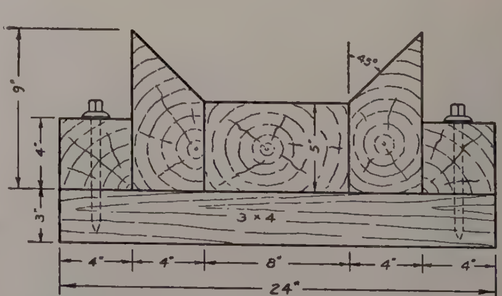

Fig. 2.—Cross section of Sykes portable chute. This shows the conventional method of holding the chute sections in place on a 3" x 4" cross tie at the joint.

wood logs are transported down the average chute. This quantity varies considerably, however, depending upon the stands of timber adjacent to the chute or above the intake at the top. Logs are generally horse skidded from distances up to 600 feet. The chute is generally about 2 feet deep at the center and about 3 feet wide at the top. Occasionally rock outcrops prevent the channel conforming to these dimensions. During freezing temperatures in the late fall or winter, the earthen chutes become icy channels and conduct the logs down to the delivery point at very low expense. If logging continues during the summer, hardwood poles are laid in the earthen channels, four poles about 6 inches in diameter at the butt end and 30 feet long bolted or spiked to crossties to hold them in place. Butts are laid down hill and the construction work starts at the bottom of the slope. There are generally four cross-ties to a 30-foot section. The degree of slope requiring successful use of these earthen chutes generally varies from 30° to 60° or more. They are used chiefly in connection with logging maple sawlogs, but are also used for basswood, elm, ash, beech, black cherry, oak, and other species found in the Central New York region. The frozen earth chute is operated only during cold temperatures and is much preferred to the form of pole chute as operated during the summer. These earthen chutes generally deliver the logs in an open pasture or field. Here they are collected by a team and skidded to elevated landings along highways. They are then rolled on skids directly onto trucks and hauled to the small sawmill.

(3) Although pulpwood chutes have been used for many years in New York, they have recently been revived in the Adirondacks. These chutes, locally known as sluices, are used exclusively for transporting 4-foot spruce and balsam fir bolts during both winter and summer, preferably the former. They are made of straight spruce poles 18 feet long and generally 4 to 9 inches in diameter. They are constructed of 3, 4, 5, 6, 7 and 8 poles and are generally of a U-shaped type. On the 3, 4 and 5 pole chutes, smaller poles (4, 5 and 6-inch top diameters) are used in the base of the channel and the larger ones (7, 8 and 9-inch top diameters) on the sides, whereas on the 6, 7 and 8-pole chutes the largest poles are used in the base of the channel and the smaller ones on the side. On one area of one mile square, 15 separate chutes were used. The principal chute was 5,040 feet long or about one mile. This was made of 280 18-foot sec-

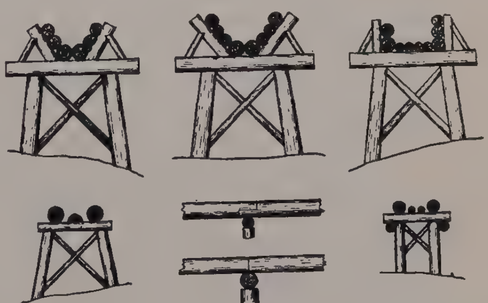

Fig. 3.—Five types of logging chutes used in transporting pulpwood and two methods of making joints. The two lower chutes are used for short steep pitches where only a few hundred cords are to be transported. The upper three are of the more permanent type required for longer distances up to a mile where large quantities of pulpwood are transported. The upper right sketch illustrates a method of banking with an extra log on one side to prevent logs jumping out of chute on curves. Generally peeled pulpwood logs of spruce 18 feet long are used. The smaller sizes are 4″ to 6″ at the top and the larger logs 6″ to 10″ at the top. Legs and braces are of cedar and hardwoods.

tions, and eight poles were used. The chute rests on the ground wherever possible. In order to maintain the chute on an even grade in crossing streams or depressions, trestles or leg supports varying from 1 to 10 feet or more in height are used. Five men constructed this 8-pole chute in 48 working days or a total of 240 man days. Eighteen hundred cords were transported down the chute or approximately one year's cut on a limited area. The drop in elevation was approximately 1,400 feet in this length or an average grade of 28 per cent. In order to retard excessive speeds 23 traps or wolf breaks, as illustrated, were placed at or above the steepest pitches. There was one intake of water from a convenient brook used to ice the chute and facilitate the progress of the logs along the lower grades near the terminus. Large bolts slide with great velocity, whereas the smaller bolts often slow down or stop on the somewhat level places. The bolts are delivered at a pulpwood dump where they are loaded on sleds and hauled to a landing along a driving stream. When the bolts become piled too high on a log dump, a special 18-foot portable section is placed at the end of the chute and elevated in order to carry the bolts to greater distances and prevent piling up at one point.

Several thousand yards of chutes were used on one operation in one year. The principal 8-pole chute costs about 26c per running foot to construct. Spruce wears out readily on chutes used continuously. Hardwoods are preferred, but it is difficult to obtain straight, symmetrical, round logs of the appropriate sizes. Balsam fir is not used because it is too weak to withstand the strains and stresses incident to the operation. One jobber's chute about 3,500 feet long was constructed in rectangular shape, with four small logs forming the base and two logs of larger size on each side. The wide, flat base permitted too much side sway resulting in undue vibration and springing. As a consequence, many bolts were thrown out resulting in undue breakage to the chute itself, as well as loss of wood. A 3-pole chute was built on one steep slope for 5c per running foot. Many short chutes are built on the steepest slopes, one being about 100 feet long and several being constructed for distances up to 700 feet in length. The 3 and 4-pole chutes are constructed at much less expense and are operated more cheaply than the 5, 6 and 8-pole chutes. A 6-pole chute may be changed to an 8 or 9-pole chute on curves or wherever there is danger of "jumping." The larger chutes are more durable and are used for transporting a larger quantity of logs for longer distances. The 3 and 4-pole chutes are used only temporarily for small quantities of pulpwood and short distances. On the short length chutes, six- and eightpenny spikes are used to retard the velocity of the bolts. They protrude about one inch and impede the progress of the bolts on curves and steep pitches. These small and temporary chutes operate most economically on straight lines and on even slopes, but they can be used with slight curves, in which case they are banked rather than increased in size by putting additional logs on the outside turns as is done with the larger chutes. On a steep grade 200 feet long with an average slope of 45 per cent and a slight curve at the top, a 4-pole chute was built in three man days. This short slide was used to transport about 170 cords over a partial cliff where road construction would have been excessively expensive. Ideal conditions for pulpwood chutes are steep gulches or slopes with heavy stands of timber (15 to 30 cords per acre) and where the cost of road construction, either for draying or double sledding, would be exceedingly expensive. It generally requires seven man days to put 100 cords of 4-foot pulp-

wood into the chute.

Chutes offer a very economical method of log transportation. For short steep slopes, about 15 to 20 per cent, various forms of chutes can be economically constructed and operated. Where timber must be hauled to the chute for considerable distances and then reloaded at the terminus for further hauling, it may be more economical to build and operate haul roads. Comparison can be made between the cost of construction and operation of chutes, and the cost of hauling and road construction directly from the skidways to the landing or delivery point of the logs.

REPORT OF THE COMMITTEE ON MARKETS

NEW ENGLAND SECTION, SOCIETY OF AMERICAN FORESTERS

THE statement is made in the 1931 report of the Committee on the Stabilization of the Lumber Industry that, since the New England lumber industry is and always will be one of small mill production, some form of clearing house for statistical data is an essential requirement to the orderly and profitable distribution of its products. At the outset the Committee on Markets wishes to make the point that it is not such an organization, essential though such may be and undoubtedly is. There have been some who have suggested that the most valuable form of endeavor for this Committee would be the compilation of periodic price lists for forest products in order to give a picture of markets. This the Committee has not done and for several reasons; the Committee on Markets has neither the personnel, the facilities nor the means of carrying on and financing such a statistical service. The distribution cost of lists, alone, is something to be reckoned with, especially when the size of the Section and the usual difficulty of collecting dues are considered. Several attempts were made in the past to prepare price lists; at private expense all members were circularized and asked to return market information. In three attempts not more than 20 replies, each, were received, and data on these were confined to a relatively few items per return —an obviously scant and inaccurate basis for a price list.

Furthermore, since 1930, markets have been so shifting and chaotic with so little material moving that there have been no real prices to be listed. Sales have been out-and-out "horse-trades" with prices not reflecting cost but the seller's urgency.

The Committee on Markets has always tried to take a broad view of the situation and in the five annual reports since its establishment in 1928 has endeavored to detect and report *trends*. Less concern has been given the cost of pulpwood f.o.b. cars at a given point than to the general price of pulpwood all over the region as related to costs, consumption and stumpage value, for the Committee has held the rather strange theory that unless and until stumpage values rise landowners will invest little in improved forest practice. So the Committee reports have attempted, in a broad way, to interpret the state of markets as it affects forestry.

Historical

Watching the New England lumber industry for the past ten years has been like watching a leaking balloon slowly deflating. (In fairness we should note that this not altogether original figure would apply to many industries equally well.) To keep the balloon afloat stumpage was dropped out first; then profits. But the balloon kept on sinking. Finally, late in 1930, wage levels were lowered. After this our balloon kept slightly aloft, but gave the occupants a bumpy and worried ride, with no hope of anything but the slow completion of the deflation. For instance, log run, round edge white pine which sold for $35 in 1920 dropped to $21 by 1927, to $17 by 1931, to $14 in 1932 and sales were noted as low as $9 in 1933. Spruce frames, a once considerable business, vanished from sight, and pulpwood dropped from $15 in 1928 to $6.50 in 1933. No. 1 common yellow birch brought $75 in 1920 but had

dropped to $40 in 1933. This drop in values was due to the importation of cheap western lumber and foreign pulp, to the decrease use of wooden containers and to the general economic collapse. One year ago this Committee was of the opinion that those who could keep on in the industry would some day in the far future be rewarded for their persistence, particularly if in the meantime they changed the industry over from one of poorly sawn lumber from portable mills to better lumber, cut to grade for specific use and intelligently marketed. No appreciable help for the sinking balloon was noted on the horizon.

The Civilian Conservation Corps

Late in the spring of 1933 deflation was unexpectedly and momentarily checked in many sections by the advent of the Civilian Conservation Corps. While of minor ultimate importance the placing of local orders for barracks lumber had a salubrious effect on many small mills all over New England, caused a slight price rise, depleted dry stocks of softwood and gave new hope to many manufacturers. The original orders, covering about 30 per cent of construction, were for native lumber. The specifications for the remainder required grade-marked lumber and, there being none such in native stock, southern and western species were used.

Currency Change

Those species which were at a disadvantage due to importations from countries with a favorable exchange were, throughout the year, given whatever advantage the gradual change in the price of the dollar in foreign markets afforded. This was particularly noticeable in spruce lumber imported from Canada.

National Recovery Administration

Continued help unexpectedly appeared on the horizon in the form of General Johnson and his N.R.A. The Blue Eagle thrust a Lumber Code, a Pulp and Paper Industry Code and a Newsprint Code into the major leaks, threw a blanket code over the whole thing and the picture was changed. It may be that a general pick-up in business had started by late summer and, due to this and other factors already mentioned, the balloon was on the ascent. Anyhow, be that as it may, the codes did arrive, and as nearly as we can see are the most dominating things in the industry today.

Markets Under New Deal

Pine.—For 1932 and a good part of 1933 the price of 1-inch round edge pine averaged $15 delivered at consuming centers. The Code price of such lumber today is $17, or an increase of about 14 per cent. Code prices on upper grades represent a somewhat greater increase than this, but at the bulk of pine manufactured is of the lower grades the 14 per cent is a fair figure for the rise of the species in general.

However, cost of operating has increased under the Code. Good pine timber, on a good lot, was operated last year and the year before for $6 from stump to sticks. Such a lot under the Code would cost about $7.50 today. An ordinary lot, with not such a good chance, which would have cost $7 last year costs $8.50 this year. This change represents an increase in cost of from 20 to 25 per cent. On this account there will be a tendency to concentrate operations on the better, smoother and more accessible lots.

Throughout the pine region stumpage has been worth from $2 to $4 for the past two years. The latter price was obtained when the timber was good and

well located. To the casual observer it may appear that stumpage has now advanced from $1 to $4, but as a general statement this is not true. Since the placing of the Code prices more lots have been bought near consuming centers; not many purchases have been made at a distance. The reason for this is obvious. The Code price allows for a short haul. In the nearby areas operators can pay more for lots than the wreckage prices which prevailed a year ago. As the distance from market increases stumpage margin decreases very rapidly, so that pine in the back country is not worth more than last year. Little grading is being done, probably for the simple reason that there is little quality lumber to grade. There is a shortage of dry pine of certain thicknesses in some sections, where a price of $20 for immediate delivery has been offered. There does not seem to be any great increase in volume of consumption, though production appears to be mounting to the extent that by fall it may be difficult to maintain the present Code prices.

Spruce.—In spruce the demand has been good and appears to be improving. Logs have been going for $13 delivered, with stumpage around $6. The Code prices on western lumber plus the more nearly equal state of the Canadian exchange have helped this species, in the Sections where spruce is manufactured locally. In the cities western and Canadian lumber still dominate the market due to quality as well as price considerations. Local mill men are not grading according to the new rules, for they feel it would be detrimental to their interests to do so since the new rules raise the grade one degree for comparable prices. Stumpage has not risen due to increased cost of manufacture and to the fact that most spruce was contracted for before the Code went into effect. However, any stumpage increase should be noted next fall.

Hemlock.—Hemlock follows along with pine and spruce and locally is doing quite well. One inch square edge boards bring $25, with logs bringing $12 delivered.

Aspen.—As was the case a year ago, there seems to be no demand for poplar, probably due to the fact that most mills have stocks on hand. One establishment in New Hampshire offered $5.50 to $6.50 per cord delivered.

Hardwood.—Hardwood prices have always been more variable than softwood prices, for quality and use have always held up prices of certain items even during the worst periods, and the same is true today except that there is a greater demand than a year ago. The Code effect has been hard to determine for there are so many grades and so many items in hardwood. Stumpage has not risen appreciably. Logs have advanced from 10 per cent to 20 per cent, but operating costs have advanced from 20 per cent to 40 per cent. White ash, snowshoe grade in the log, delivered brings $33 to $35 for No. 1, and $20 to $23 for No. 2. Handle grade brings $18 delivered. Veneer logs of birch and maple bring $23 for No. 1 and $14 for No. 2. Bobbin logs bring from $14 to $17.

In the case of hardwood lumber there seems to be trouble. Minimum prices have been set, but the terms and conditions seem to be indefinite and are interpreted variously. For instance, no price is fixed in the Code for log run round edge hardwood, the chief output of many mills; likewise no price is fixed for white birch though some claim that white and yellow go together. The main difficulty, however, seems to be in the prices themselves. As set up all agree that they are detrimental to the small mill. There is a price differential for sub-grade stock of up to $4 per M. This means that mills producing graded lumber sell their product at stated minimum prices for each grade, and then can dis-

pose of their poor stock for $4 less than the price of the lowest grade. The product of the small mill is largely sub-standard; it is produced, however, at a differential of much more than $4—more nearly twice that in fact. For instance, a small mill may produce yellow birch lumber which is just as usable as No. 1 common, but which, due to width, appearance or manufacture, may not qualify for that grade. Pre-code this could be sold at from $8 to $10 less than big mill birch, but now it cannot. Hence, the small mill man cannot sell his lumber until the big mill man has sold his better lumber—unless he chisels. While we have no specific instances at hand we have a widespread body of opinion which claims that most all small mill lumber is sold in violation of the Code. Code prices, however, are admittedly based on meager data and undoubtedly revision will be made when data are available, and should remedy this condition. There is another factor to be considered at present: the severe winter throughout the north country has brought the supplies down to such a low point that prices may take care of themselves and if so those who are selling in violation of the Code will have hurt only themselves.

Pulpwood.—The pulpwood situation is something different. Two codes, one for the newsprint industry and one for the rest of the paper and pulp industry, have been formulated. There is no code, however, for pulpwood. That the pulp and paper industry, if any, needed help is indicated by General Johnson in transmitting the Newsprint Code:

"The newsprint industry is in a very serious condition. Consumption has fallen from 3,200,000 tons in 1929 to 2,800,000 tons in 1932. The capacity of the mills in the United States is about 1,800,000 tons. The price has fallen from $65 per ton delivered, in 1929, to $40 in 1933.

"It is doubtful whether even the most efficient mills can produce paper at this price in either Canada or the United States. In fact, five out of eight of the largest producers in the United States are in receiverships, as well as practically all the Canadian mills which are not supported by their affiliates.

"As newsprint is imported duty free the United States and Canada branches of the industry are practically one from a competitive standpoint, and consequently the manufacturers in the United States can obtain no reimbursement through increased prices for any additional costs which may be imposed upon them by the Code."

Production dropped to 946,000 tons in 1933, but about 2,000,000 tons were imported, 65 per cent of this coming from Canada, and 35 per cent from Europe; all duty free and not produced under NRA wage schedules. Unless and until this situation is remedied there can be little hope for the industry.

Throughout the spruce region there seems to be some demand for pulpwood and prices have stiffened, due to the increased labor cost of manufacture. For the past year prices have been from $6.50 to $8 delivered. This year's cut will be from $1 to $2 per cord higher. Rough wood is being cut at an advance of 50c to 75c a cord. A fair estimate of the 1934 schedule for peeled delivered wood is as follows: Stumpage, $1.50; cut, peel and pile, $3.50; haul, $2.50; interest, insurance and shrinkage, $.50; overhead and profit, $1.00.

Referring again to the codes: the pulp and paper industry code applies only to the manufacturing end, as does the newsprint code. In the latter, however, there is a clause under Article IX which declares that the industry wishes to conserve forest resources and bring about their sustained production, and will join with the lumber and timber products industries in planning practical measures to

carry out this purpose. Several years ago much concern was felt about importations of Russian wood. This past year less than 50,000 cords were imported, none of which came to New England. In addition 7,500,000 feet of spruce lumber were brought in.

General

The general impression, and this is borne out by facts, is that, with the exception of the pulp and paper industry, the New England lumber industry is in a more advantageous position than a year ago. Prices are higher and demand is good. Your Committee unanimously attributes this to the Code. Indeed, some may be attributed to anticipation of the Code. That is, in some cases, especially in local markets, there was a mark-up of prices due to knowledge that the Code was coming. There is a difference between the large markets and the small ones. In the former volumes are better; in many of the latter there is a small change. Bank deposits being tied up has held back business but the Civil Works Administration has helped it along. So the net result is no change. Going back to the woods we find that Code wages and hours are generally adhered to; the result being an increase in cost of production. Hence, increased price is not reflected in stumpage, except locally, and for the very well located lots. There is one ramification of relief work that is rather unusual. The CWA might be said to be indirectly influencing stumpage prices for the better since many farmers who normally log have not done so this winter, but have worked in the CWA. The biggest problem so far is found in holding up minimum prices, which are causing hardship for the small mills, particularly in hardwood mills. There are undoubtedly evasions of the Code though not much action is taken on them. The Committee looks for some revision of Code price protection in the near future.

C. R. Lockard, *Chairman.*
R. C. Bryant
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A CORDWOOD STUDY[1]

By A. C. McINTYRE

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Factors influencing the solid cubic foot contents of a cord must be carefully considered in using this unit of measure. Only a few studies have been undertaken using the tree as a unit, instead of the average stick in the cord, to obtain cordwood converting factors. Data are here presented showing the variation in number of pieces, and cord volume as the average tree d. b. h. composing the cord varies.

THERE probably is no unit of measure in use by foresters which is more variable than the cord (1) (5). The term itself has been legally defined differently in different localities.

In speaking of a cord, a standard cord having dimensions of 8'x4'x4' and containing 128 cubic feet is usually meant. There are, however, several other cordwood units recognized, such as the long cord (160 cubic feet), chemical wood cord (144 cubic feet), cord foot (32 cubic feet) and the short cord which is extremely variable.

A number of factors affect the solid cubic foot contents of any cord and their influence varies with the length of the sticks. Size, crookedness, and roughness of stick have the greatest effect (2) (8).

The cubic foot volume of a standard cord of perfect cylinders or frustrums of cones, having the same diameters, would not exceed 101 cubic feet and for a long cord (8'x4'x5') 126 cubic feet if piled square. If piled hexagonally the values would be 116 cubic feet and 145 cubic feet respectively. These values are 78.5 per cent and 90.7 per cent of the total cubic foot volume found in rectangles of the cord's dimensions. Theoretically, with mixed piling of cylinders of different sizes, it is possible to get as much as 120 cubic feet per standard cord. These values are the ultimate that could be expected but due to stick irregularity are never attained in the woods.

Previous Investigations

Evaluation of factors affecting the solid cubic foot contents of stacked cords has been the purpose of a number of investigation (3), (4), (6), (8). Converting factors have been developed, the use of which permits closer approximation of the volume of wood which is present in any cord unit. With the exception of the study made by Schnur (6) previous investigations have been based on the size and shape of the average stick found in selectively piled cords. In arriving at cordwood volume, from timber cruise data, the converting factor which most nearly approximates conditions found is divided into total cubic foot volume. Cordwood volume tables have likewise been computed in this way. Schnur's study based on tree d.b.h. shows that, with certain hardwoods and under conditions which he investigated, only one converting factor need be applied.

From the data reported in this paper it seems highly doubtful if a single converting factor would be found applicable when the larger sticks are not split or when the largest trees being cut do not exceed ten inches d.b.h.

Cordwood converting factors based on the tree and not the stick as a unit would have more general use in volume determinations such as growth or yield studies. It was with this in mind that the study here reported was undertaken.

[1]Contribution from the Dept. of Forestry, The Pa. State College. Publication authorized February 21, 1933, by the Dir., Agric. Exp. Sta., as Tech. Paper No. 583.

Methods of Study

The data presented were obtained on three areas where Virginia pine (*Pinus virginiana*), pitch pine (*P. rigida*) and mountain pine (*P. pungens*) were being cut for pulpwood. About 85 per cent of the cut was Virginia pine. The unit of measure was the long cord (8x4x5) feet which is the prevailing unit for pulpwood throughout the region. Stand ages varied from 24 to 55 years. Utilization was to a four-inch top which, however, was not closely adhered to. Tree d.b.h. ranged from small trees from which only one bolt could be cut to a maximum of 16 inches. Total tree heights ranged from 20 to 65 feet with merchantable heights from five feet (one bolt) to 55 feet.

Each cord was piled on a rack which would hold exactly one cord. Sufficient wood was permitted to project above the four-foot end stakes so that all irregularities in finishing off the pile would be compensated for. No selective piling was undertaken, each cord being composed of many trees of different sizes.

Data for volume tables were also collected; U. S. F. S. Forms No. 558a were used for this purpose. Using calipers, diameter measurements at both ends and the middle of each bolt in every cord were made. In order to check the accuracy of these measurements, eight cords were measured at the time the rack was being filled and again when the bolts were removed. Differences of less than one per cent occurred. Each butt bolt was carefully noted and measured so as to check the number of trees entering into the cord volume. A total of seventy-eight full cords were measured in this way. A comparison was made between values obtained by using end diameters as against the middle diameters of each bolt. Slight variations occurred which could be accounted for by differences due to flare on the butt bolts. Such differences would not exceed 3 per cent even though a cord was composed of only butt bolts.

The average stick in each cord was computed and the average d.b.h. of the trees making up the cord determined. Data were then averaged by one inch diameter classes and plotted as shown in Figures 1, 2, 3, 4. The consistency of the data is apparent. This accuracy is believed to be due to the use of the rack and the securing of consistent data uninfluenced by slight variations in cord size which would occur if the cords were piled on the ground or only single end stakes were used.

Size of Bolts and Cord Volume

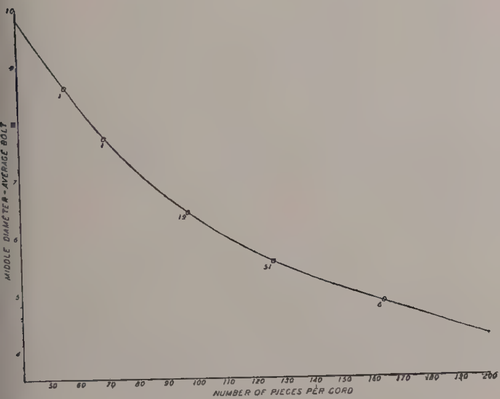
The number of bolts required to make one cord varies with their size. This relationship is shown in Figure 1 and Table 1. As the average size of the bolts increases, the number of bolts necessary to make a full cord decreases. These data collected on pine check very closely with those obtained by Churchill (2) on spruce.

An increase in the number of bolts per cord reduces the solid cubic foot contents, as is shown by Figure 2 and Table 1. Rough or knotty bolts resulting from poor manufacturing and heavy-limbed trees may affect the total number of bolts and cubic volume by as much as 4 per cent (8).

Size of Tree and Cord Volume

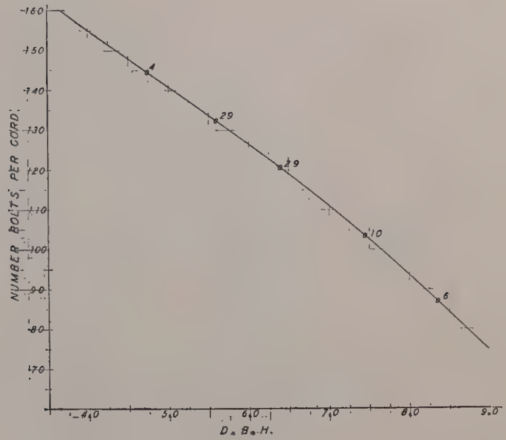
The number of pulpwood bolts that can be cut from a tree and their average diameter is dependent on tree d.b.h., merchantable length and form. From the data obtained in this study it seems apparent that tree form when considered in terms of actual cutting, has little if any effect.

During the progress of this study and one of growth and yield of Virginia pine 1508 tree volumes were obtained on nine different operations covering many site and age conditions. The form quotient of all of these trees was computed. It was found that over one third of them had form quotients between .60 and .69 and that two thirds of the trees had form quotients



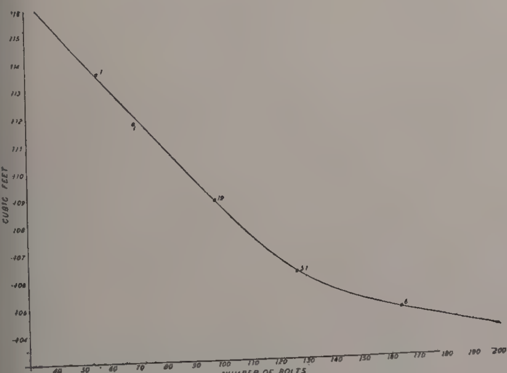
Basis 78 cords—9,426 bolts.
Aggregate deviation + 0.004 per cent.
Average deviation ± 2.307 per cent.

Fig. 1.—Influence of size of average bolt on number of pieces per cord.



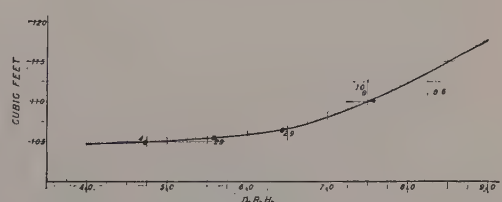
Basis 78 cords.
Aggregate deviation —0.057 per cent.
Average deviation ± 10.08 per cent.

Fig. 3.—Effect of average tree size, d.b.h., on number of bolts per cord.



Basis 78 cords—9,426 bolts.
Aggregate deviation + 0.045 per cent.
Average deviation ± 1.71 per cent.

Fig. 2.—Effect of number of bolts per cord on solid cubic foot contents.



Basis 78 cords.
Aggregate deviation —.171 per cent.
Average deviation ± 1.688 per cent.

Fig. 4.—Relationship cord-cubic foot volume to average tree size, d.b.h.

between .56 and .75. This was true regardless of the area on which data were obtained and it is thus apparent that extreme variations in form will not be found.

TABLE 1

INFLUENCE OF NUMBER OF BOLTS PER CORD ON CUBIC FOOT VOLUME AND DIAMETER OF AVERAGE BOLT[1]

Number of bolts per cord	Cubic feet per cord	Middle diameter of average bolt
40	115.3	9.8
50	114.1	9.1
60	113.0	8.3
70	111.9	7.7
80	110.8	7.2
90	109.7	6.7
100	108.6	6.3
110	107.6	6.0
120	106.7	5.7
130	106.0	5.5
140	105.5	5.3
150	105.2	5.1
160	104.9	4.9
170	104.7	4.7
180	104.4	4.6
190	104.2	4.4
200	104.0	4.2

[1]Basis 78 cords—9,426 bolts. Average deviation of individual cord values from curve, plus or minus 2.307 per cent; aggregate deviation 0.004 per cent high.

Merchantable length is, of course, influenced by tree form. On the operations where this study was made, strict adherence to the four-inch cutting limit was not insisted upon. There is a decided tendency on the part of cutters to take every foot that can be easily worked up and sold, and this practice tends to increase the number of bolts per tree. The diameter of the large end of the last bolt is more often used as a guide.

In Figure 3 and Table 2, the influence of the average size (d.b.h.) of trees being cut on the number of bolts required to make a cord is shown. The number of bolts per cord decreases steadily as the average d.b.h. of the trees (stand) being cut increases.

In Figure 4 and Table 2, the effect of tree d.b.h. on volume of wood per cord is shown. The number of cubic feet per cord increases as tree size increases.

Data obtained on southern pines (7) shows this same trend, but values are considerably higher than those secured in this study. This is probably due to better manufacturing. The three pines worked with in this study are characteristically limby, and smooth cylindrical bolts are difficult to obtain.

CHECK ON APPLICABILITY

A check was made on the applicability and conformity of the data presented in Figures 1, 2, 3, and 4. A sample of 313 trees was taken and diameter class averages obtained as shown in Table 3. The average middle diameter of the merchantable bole was read from the U. S. Forest Service 558a forms.

TABLE 2

INFLUENCE OF AVERAGE TREE SIZE (D.B.H.) ON NUMBER OF BOLTS PER CORD AND CUBIC FOOT VOLUME

Average tree d.b.h. inches	Cubic foot volume per cord	Number of bolts per cord
4	104.7	155
5	105.1	141
6	105.9	126
7	108.1	111
8	112.4	94
9	117.6	75

The number of bolts or cubic feet per cord that would be estimated in terms of average tree d.b.h. were compared with those obtained by basing the estimate on the average diameter of the merchantable bole which would approximate the average bolt that would be cut. Differences between the two methods of estimating are given in the right hand columns in terms of per cent.

It is apparent that the accuracy of estimate by use of average tree diameter can be obtained comparable to that of any other method. Two field checks, based on actual cruise and cutting and piling of the

TABLE 3

CONFORMITY OF VALUES OBTAINED BY ESTIMATING CORD VOLUME ON BASIS OF AVERAGE TREE D.B.H. WITH THOSE OBTAINED FROM VALUE FOR AVERAGE STICK IN CORD

Sample number of trees	Average d.b.h. inches Ob	Ib	Estimated contents Number bolts (Fig. 3)	Cubic feet (Fig. 4)	Average diameter merchantable bole inches[1]	Estimated contents Number bolts	Cubic feet	Per cent difference in terms of aver. tree diameter Bolts	Cu. ft.
118	5.99	5.44	134.3	105.8	5.03	152.0	105.1	13.2	0.7
111	7.04	6.40	120.5	106.4	5.64	122.4	106.5	1.6	0.1
49	8.42	7.65	100.0	110.6	6.33	100.0	108.6	0.0	1.8
35	9.28	8.41	86.1	114.4	7.04	82.5	110.5	4.2	3.4
Total		Averages							
311	7.11	6.46	119.6	106.5	5.67	121.7	106.6	1.7	0.1

[1]Merchantable portion of bole to a four inch top inside bark and allowing for a ½ foot stump.

trees, were made. On one plot the estimated cut was 3.4 per cent low. Data on the other plot are given in Table 4.

TABLE 4

COMPARISON OF ESTIMATE OF CORDWOOD CUT FROM ONE ACRE AND THAT ACTUALLY CUT

Number of merchantable trees per acre	401
Average stand d.b.h.—o.b.	6.70
Average stand d.b.h.—i.b.	6.09
Estimated number of bolts per tree	3.08
Actual number of bolts cut per tree	3.61
Estimated, from Fig. 3, number of bolts per cord	125.0
Actual number of bolts per cord	136.0
Per cent difference	+8.1
Estimated, from Fig. 4, number of cubic feet per cord	105.96
Actual cubic feet per cord	106.85
Per cent difference	+0.83
Estimated number of bolts to be cut (401 x 3.08)	1,235.00
Actual number of bolts cut	1,449.00
Per cent difference	+14.76
Estimated number of cubic feet to be cut $\frac{105.96}{125} \times 1{,}235$	1,046.00
Actual number of cubic feet cut	1,144.00
Per cent difference	+8.56
Estimated number of cords per acre	9.88
Number of cords actually cut	10.66
Per cent difference	+7.31

The tendency on the part of the operators to take as much as possible of the tree below the diameter limit tends to increase actual volume over that which is estimated. The data in Table 4 illustrate this tendency.

The estimate of 3.08 bolts per tree was made from data obtained on other areas where comparable stands were being cut. All other estimates are based on values read from Figures 3 and 4. It is believed that if the cutting limit of 4 inches had been more closely adhered to, the estimated and actual cut would not have differed by more than 5 per cent.

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CONTROL OF THE WHITE PINE BLISTER RUST

SUB-COMMITTEE REPORT TO NEW ENGLAND SECTION, SOCIETY OF AMERICAN FORESTERS

THE paramount fact in regard to white pine blister rust caused by *Cronartium ribicola* is that without control, eastern white pine (*Pinus strobus*) cannot be perpetuated in New England except over limited areas where the number of Ribes (currant and gooseberry) bushes is small. Even on such areas it is likely that white pine will be eliminated ultimately, or so badly malformed and reduced in amount as to be practically worthless, but the damage will be slow enough to give a false sense of security. Blister rust is a disease caused by a virulent, introduced parasite and it is axiomatic that direct control is the only satisfactory solution against a disease of this type. Over the years that blister rust has been epidemic in the East, there is no indication that white pine has developed the slightest resistance to it. The disease attacks and kills thrifty trees more readily than it does slow-growing, suppressed ones.

Blister rust is not spectacular. On unprotected areas, the disease increases slowly at first and then rapidly. Seedlings and small saplings are infected and killed quickly, while poles and larger trees are killed slowly. Consequently a white pine stand where blister rust is epidemic may appear little affected for many years, judging only by the larger trees, but there will be an almost complete absence of seedlings and small saplings. The successive crops of seedlings succumb after a few years and nothing is left to perpetuate the stand when the mature trees are cut or finally killed.

Of 27,273,000 acres of commercial forest area in New England, careful estimates indicate that 2,042,000 acres are occupied by pure stands with from 80 to 100 per cent white pine, 2,318,000 acres by mixed stands with 21 to 79 per cent white pine, and 1,608,000 acres by stands with some representation of white pine. Over the forests of New England where white pine forms a significant proportion of the stand (21 per cent or more), it is a highly desirable, and probably an essential species. At present most of the white pine lumber on the market is low in quality because it comes from relatively young stands of second growth which have been allowed to develop without cultural operations such as thinning and pruning, which have not been allowed to mature to desirable quality because of high taxes, and some of which have been damaged by white pine weevil. Furthermore, most of it is poorly manufactured. Grade for grade white pine commands a higher price than any other New England softwood.

The future trend of forest practice should be towards less white pine in pure stands and more in mixtures, combined with weeding, pruning, and thinning of these stands throughout their life. Thinning, if carried on at the same time as the first Ribes eradication in an infected stand, must be done lightly because infected trees not apparent at the time of thinning may die later in sufficient numbers to result in understocking. If feasible, it is advisable to delay thinning until several years after the first Ribes eradication. In addition white pine must be grown to a greater age to secure quality. In general, planting pure white pine on open fields should be discouraged, but pure planting on areas coming up to aspen, gray birch, cherry, inferior oak

and other species which will act as nurse trees for the pine is justifiable. Pure pine under this last condition will form a satisfactory stand with damage by the white pine weevil adequately reduced, provided the nurse trees are not completely removed before the first sixteen foot log at least has been formed. In sections where there are no continuous stands of white pine covering extensive areas and weevil damage is light, pure plantations even on old fields are feasible. However, better quality pine will not come from pure stands, unless pruning is practised.

Eastern white pine is a wood adapted to special uses. At present the market for it is poor, but so is the market for all other species in the region and in fact for the country as a whole. Economic depression in this country has always been followed by recovery, and judging the future by the past, growing white pine will be economically justified. However, the quality of white pine must be raised, so that it will not have to compete directly with the lower grades of lumber from other regions. Furthermore, the low quality eastern white pine from second growth in New England is competing at present with high quality western white pine from virgin growth in the Inland Empire. Most eastern white pine lumber now on the market would be unsalable in the West. Once the virgin stands of western white pine are liquidated, eastern white pine will be able to compete more closely on a quality basis. In addition, charges for fire protection, blister rust control and transportation to market will be much higher for western white than for eastern white pine. Probably large areas in Idaho will be eliminated by blister rust from the future production of western white pine so that the supply of timber from second growth of this species will be reduced. These factors favor the future competitive position of eastern white pine.

If white pine ceases to be a factor in New England forests, there is no satisfactory replacement for it in sight. Red pine, which grows more rapidly than white pine over short rotations on poor soils, must be initially established throughout most of the region by planting. Furthermore it reproduces poorly here. It is unlikely that enough red pine will be planted to maintain a paying crop on the extensive acreage of abandoned farms, and cutover and burned over areas where white pine establishes itself so aggressively. Red pine will also have to bear carrying charges for insect control, the European shoot moth for example, and probably for disease control, as indicated by the appearance of a disease known as "resinosis" in New York and a new canker disease in southern Connecticut. If the control of gypsy moth and other insect or fungous enemies of hardwood stands that may occur in the future should eventually fail, conifers will increase in the hardwood forests of New England, and then white pine, if protected from blister rust, would be the most important species.

The replacement of eastern white pine by an exotic is a long time undertaking and at best could only be done over limited areas. It would require fifty years or more to establish the suitability of an introduced species. The Macedonian white pine (*Pinus peuce*) which is being experimented with in this country because it seemed to have marked resistance to blister rust, has recently suffered severely in the seedling stage from the rust in Germany.

Aside from its commercial value when of good quality, white pine has a real but intangible aesthetic value. Over the entire country coniferous forests have a much greater appeal to recreationists than hardwood forests. The coniferous forests are all-year forests, while hardwood stands during their leafless period are not attractive. Much of the beauty of exten-

sive areas in New England is generally recognized by the public as largely attributable to white pine. Its value is strongly emphasized by many estate and resort owners.

An effective method of control has been developed and extensively applied in New England under the leadership of the federal government coöperating with the states. This consists of the eradication of Ribes from within and around white pine stands for a distance of 900 feet. The eradication of the European black currant and its elimination from the nursery trade has proven invaluable. The establishment and maintenance of Ribes-free zones around nurseries to assure the production of white pine planting stock free from blister rust has been extremely helpful to both the nurserymen and the purchasing public. The initial eradication of Ribes by the end of the year 1933 had protected the major portion of pine acreage in New England worth protecting as shown by the figures in Table 1:

TABLE 1

State	Percentage of pine area worth protecting on which initial control has been established	Percentage of pine area worth protecting on which control has been maintained by reworking for Ribes
Maine	68.2	1.5
New Hampshire	86.3	12.1
Vermont	67.6	13.5
Massachusetts	99.4	23.7
Rhode Island	100.0	8.1
Connecticut	96.9	30.6
Total—New England	81.2	10.2

With the large acreage already protected, the future of white pine in New England is assured as far as blister rust is concerned, provided maintenance work consisting of necessary re-eradication is continued. Without Ribes eradication, white pine will suffer the same fate as chestnut, although the elimination of white pine will be slower. To abandon blister rust control now would be to lose a battle that has been won and sacrifice the substantial public and private investments that have been made in the control of this disease. The annual carrying charge for protecting white pine from blister rust in blocks of 50 acres and upwards will vary from 4 to 15 cents per acre per year over the period of the rotation. For smaller areas the cost will be higher. While this is an additional charge against white pine, it is likely that no other species can be intensively managed in New England without carrying charges for protection against insects and diseases, in addition to fire.

Blister rust cannot be controlled by silvicultural methods, although control can be aided by proper forest practices. Whenever possible, planting sites where Ribes are few or absent should be selected. Operations in immature stands increasing the quantity and particularly the quality of timber, lessen the proportionate cost of control. The maintenance of an unbroken forest canopy in white pine stands will keep Ribes within the stand shaded out and reduce damage, but these shrubs will flourish in openings within a stand and in surrounding open areas.

The results so far secured in protecting white pine are directly attributable to the leadership of the Division of Blister Rust Control of the U. S. Department of Agriculture in coöperation with the state authorities. If this leadership had not been made available, most of the white pine in New England would have been abandoned to blister rust. For future success it is necessary that this leadership be continued, so that the owner desiring to protect his timber can have the expert advice and supervision needed to make Ribes eradication effective. The funds for this Division have been eliminated

from the regular appropriation for the Department of Agriculture for the fiscal year beginning July 1, 1934. After that the work will be carried on with emergency funds which may be summarily cut off at any time, and probably will be within a year or less. This will eliminate the trained and experienced supervisory personnel which is essential to the success of blister rust control, and on much of the area already protected the disease will reassert itself. This policy cannot be too strongly condemned, and the New England Section should urge the restoration of blister rust control to its regular status by the Congress.

To sum up then, eastern white pine is a highly desirable species silviculturally over a large forest area in New England. Economically its position can be improved by growing it for quality rather than quantity. This will necessitate thinning, pruning and other cultural practices, as well as allowing timber to mature to a greater age. It should be grown in mixed stands as much as possible, particularly in mixture with hardwoods, although it will also continue to be grown in pure stands to some extent. The species cannot be perpetuated without control of blister rust, but this parasite can be controlled effectively and at a cost which can be borne by good stands. Blister rust control should be applied to planting sites, to cutover areas having enough seed trees to assure a good representation of white pine in the next crop, and to pure and mixed stands having a sufficient stocking of pine to justify the cost of protection. The minimum amount of white pine in mixture which will warrant protection must depend on the individual tract and the owner's desires. On the best soils even 20 per cent or less of pine may justify control. In stands whose purpose is simply that of cover no expenditures for control are warranted.

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THINNING LODGEPOLE PINE STANDS IN THE CENTRAL ROCKY MOUNTAIN REGION

By P. V. WOODHEAD

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THE President's Emergency Conservation work in 1933 afforded the first opportunity for stand improvement work, on a comprehensive scale, in immature lodgepole pine in the national forests of Region 2. Thinning in lodgepole pine occupied a prominent place among the numerous E.C.W. projects as is witnessed by the fact that 9,950 acres were thinned by Civilian Conservation Corps workers in the national forests of Colorado and Wyoming. In addition 8,790 acres were thinned late in 1933 by crews employed under the NIRA program for the relief of unemployment. It is estimated that NIRA crews will thin about 2,100 acres more before work is discontinued this winter.

The thinnings were restricted very largely to single-storied, densely-stocked stands of second growth lodgepole pine, which are the result of natural reseeding on burned-over areas. In composition, these stands are practically pure. They are from 40 to 60 years of age and consequently in that period of development when the most vigorous response to liberation may be expected. These stands are ordinarily continuous on burned-over areas, being broken only occasionally by small "parks" occupying the heavier and moister soils, and by openings where the soil is too sterile to support many trees or other vegetation.

Lodgepole pine seedlings establish themselves in great number, 1,000 to approximately 100,000 per acre, on many burned-over areas. Furthermore, about 70 per cent of the seedlings are established within the first five or six years after fires or very heavy cuttings have removed the older timber. This fact has a decisive influence upon the subsequent development and character of the stand since intensive competition for light and food exists almost from the inception of growth. On the better sites where the soil is deep and well-drained, the more vigorous seedlings forge ahead overtopping their neighbors. With the continued development of the dominant class, a natural thinning takes place through the death of the less vigorous trees.

The typical single-storied stands, greatly in need of thinning, are found on the medium to very poor sites; with rather shallow, residual, gravelly soils, generally of granitic origin. The extreme examples of over density on poor sites are the so called "dog-hair" stands. At 50 to 60 years of age the average height is often less than six feet. Diameters will run from one-half inch to two inches. This condition is the result of competition so intense that growth becomes stagnant very early in the life of the stand. The comparative sterility of the soil prevents the development of outstanding dominants with sufficient vigor to forge ahead. Strangely enough mortality is negligible. Growth is, of course, almost imperceptible.

The area occupied by the "dog-hair" stands is much smaller than that by first quality sites where fairly satisfactory natural thinning is in progress. Between these extremes are extensive areas of medium quality sites occupied by 40 to 60 year old stands consisting under average conditions of 2,000 to 4,000 trees per acre. Diameters range from one to six inches with averages of about two and one-half inches breast high with rather distinct crown classes.

These stands on medium quality sites were generally selected for thinning in 1933.

Thinning Specifications

Thinning specifications were written by the Regional Office of Forest Management.[1] They provided for thinning essentially from below by "retaining in the stand dominant and codominant trees to the fullest extent possible consistent with the average spacing desired." Quality of trees left in the stand was given precedent over rigid regularity of spacing. Crowns of the residual stand were released by cuttings which would be classed as Grade D extra heavy thinnings. Western gall rust (*Peridermium harknessii*) and mistletoe infected trees were removed unless urgently needed to provide approximately the spacing indicated by the following guides:

(1). Space approximately 6 by 6 feet (1200 trees to the acre) where the trees in the stand are under six feet in height.

(2). Space approximately 8 by 8 to 9 by 9 feet (680 to 540 trees per acre) where the trees in the stand are from 6 to 12 feet in height.

(3). Space approximately 10 by 10 feet (435 trees per acre) where the trees in the stand are from 12 to 25 feet in height.

Ordinarily trees six inches or over, d.b.h., were not cut. Exceptions were made of the typical "wolf trees" and cases where the felled material could be utilized by the Forest Service for the construction of improvements. Green aspen, a short lived species, was not cut. The only pruning was incidental to cutting.

These specifications were modified on areas where it was desirable to take into account the aesthetic results as well as the improvement of the stand. Wider spacing was used on recreational areas, such as those used for camp grounds. Dead trees were removed and occasional pruning was done. Trees were cut or left, as necessary, to create or preserve pleasing vistas.

Considerable experimental work was done, in connection with thinning immediately adjacent to highways, before a satisfactory method was established which would result in a thinned screening strip to relieve the startling appearance, to the layman, of the heavy thinning beyond. The width of the highway clearing was not increased even though occasional trees below average condition had to be left. The first line of trees parallel to the highway was thinned to one-half standard spacing. In the next line of trees the spacing, at right angles and also parallel to the road, was reduced to about half of the standard. The trees selected to be left were those that stood back of the openings, as viewed from the highway, in the first line. The third line was also moved back only half of the standard distance and the "leave" trees selected to further close the openings. This arrangement effectually screened the thinning which was not modified as to spacing beyond the third row.

Basis for Spacing Specifications

The foregoing spacing specifications were written with consideration for the practical certainty that the thinned stands will have to grow to maturity without benefit of further intermediate cuttings and for the management objective, which is a railroad tie or telephone pole rotation. No market exists at present for the small trees cut from sapling stands and the probability that markets will develop for future intermediate yields is remote. It was therefore necessary to adopt liberal spacing standards in order to release the residual stand from stagnation influences for the remainder of the rotation. The object was

[1]S—Supervision, Medicine Bow. Stand Improvement, 7-31-33 Specifications for Thinning Immature Stands of Lodgepole Pine.

to accomplish this without creating openings in the canopy which might be detrimental to the forest soil and without eliminating possibilities for moderate and beneficial crown competition within the next decade or two. It was also necessary to provide a margin for possible losses.

The policy is based on personal judgement as to the application of the results of limited controlled experiments, and on practical experience, in thinning lodgepole pine and other conifers in Region 2 and elsewhere.

Disposal of Slash

The crowns of trees in dense stands of lodgepole pine are characteristically scanty. The amount of brush is small compared with the number of trees felled in a thinning operation.

Trees were felled in one direction, on slopes usually up or down hill, so that the slash would lie as closely to the ground as possible. The trees removed in thinning were left as they fell except beside roads and trails and around camp grounds and other areas where a concentration of human use is to be expected. Strips were cleared at these places varying in width according to conditions and the debris piled and burned. Along highways the cleared strip ordinarily extended 25 feet from the edge of the timber. The amount of slash on accessible areas was further reduced by farmers and others who were encouraged to remove material that could be utilized for the construction of wooden fences, small farm buildings, and for fuel.

The fire hazard will be increased for four to six years after thinning because the dry slash will ignite more readily than the natural cover under unthinned stands. The danger will be comparable to that which exists on most lodgepole pine timber sale areas. There will no doubt be fire losses during the first few years that will be attributed to the presence of slash. However, it is pertinent to remember that unthinned stands of lodgepole pine saplings are a high hazard during periods of serious fire weather. The close canopies will carry crown fires that, when once under way, do as much damage and are as difficult to control as slash fires.

Mechanics of Thinning

Thinning crews consisted of a foreman who was a trained forester, one or two subforemen selected from the enrolled personnel, and from 15 to 25 choppers. The number of men that can be efficiently supervised by one foreman depends upon the topography and the density and character of the stand. The larger crews can be used only on fairly level ground in continuous stands of unchanging density and character. The work is more difficult to supervise on steep slopes or where occasional openings occur in the stand. For average conditions crews of 15 to 20 men are the most efficient from the standpoint of both quantity and quality of work.

Trees to be cut or to be left were not marked because, after trial it was found that better results were obtained without marking. It is difficult to mark dense saplings stands of lodgepole pine. As a marker proceeds through the stand it is next to impossible for him to select trees very far ahead or to look back and see the trees he has designated to leave. On the other hand, the job of selection is fairly easy if the stand is rapidly opened by clearing the smaller suppressed trees which obviously must be cut and then, by a gradual process of elimination, reducing the stand to near the expected final density. When this stage is reached the cutter can better size up his trees from the standpoint of spacing, disease and general condition and with of course more caution complete the thinning. Questionable trees are called to the attention of the foreman or they are sometimes left to be cut by the foreman, one of the sub-foremen or by a follow-up crew of es-

pecially competent men. Success of the method depends upon selecting the better type of men to make up the thinning crews, thorough training, constant vigilance on the part of the foreman and frequent inspections by the camp superintendents and by forest officers.

Very close supervision of the crew is necessary when the cutting approaches natural openings in the stand and where small groups of trees occur in openings. The tendency of the average chopper is to carry the regular spacing out into the openings where little or no thinning is needed.

Crews were trained by starting with a foreman, the full quota of sub-foremen and two or three choppers. When these men developed proficiency small groups were added from time to time until the crew was built up to full strength.

Thinning areas were laid out so that a crew could advance into the woods with a fairly even front. A strip about thirty feet wide was assigned to each man. Foremen and sub-foremen worked behind the choppers, cutting or making decisions regarding questionable trees as well as supervising the work of the crew.

A RESEARCH FORESTER LOOKS AT HIS JOB[1]

By "A. FORESTER"

SOME years ago, a graduate forester of less than twenty-four hours' standing, I boarded a train en route to my first permanent job. Thereafter, I cruised, mapped, surveyed, fought fires, and eventually administered, in various capacities, sections of a sizable forestry organization. My day developed into a program of eight hours of sleep and sixteen hours of fire organization, pumps, hose, speeder accidents, tires, tubes, stumpage prices, outstanding accounts, and what have you. I wanted to keep in touch with all new developments, but, while I knew what "hour-control" involved, that there was a blister-rust war on, that Toumey had written something good on silviculture, and a few similar high-lights, I found it a losing battle. Hiding my ignorance behind a cloak of silence and an expression (perhaps imagined) of profound and tolerant knowledge, I listened with some awe to veritable youngsters, doctors and masters of this and that, discuss PH., ecological factors, site indicators, and various other mysteries, escaping with a sigh of relief to my familiar fires and timber sales. Perforce I was happy to see a timber sale completed without worrying too much about problems of regeneration, or to see my ground fire extinguished without caring whether it was arctostaphalos or chrysoplemium that had been consumed. In other words, I was probably a fair example of the average forester in Canada who has no time to practice forestry.

Twelve months ago, as the result of a chain of happy, or unhappy, circumstance, I found myself placed overnight in charge of a forest research organization, a well-organized and staffed research office of some years' standing, with all the trimmings from library to nurseries and experimental forests; permanent plots by the hundreds; with "F" projects and "I" projects and "ME" projects; member of the International Union of Forest Research Organizations; correspondent of universities and research organizations of Europe and America. For twelve months I have been a dual personality. Number One goes to the research office, to the field, and to conference, trying to pick up the loose threads, and to organize, coördinate and understand in his mind the work prosecuted and projected both by my own office and other research centers. The other, Number Two—the "practical" forester of other years—watches this proceeding with a smile compounded of sympathy, amusement, and a little impatience. The one, a hundred-percent research officer interested in his work, without a doubt regarding its value, and loyal to his staff and their undertakings; the other, something of a Doubting Thomas, ready to criticize and perhaps getting a clearer picture of the problems as a whole. Number Two has some serious fault to find with forest research in North America. Number Two writes this dissertation and, incidentally, writes it *now* lest he be submerged and browbeaten out of the intention within the next year by a complacent Number One, no longer so badly at sea in his new surroundings.

To vent all my accumulated spleen would prove tiresome. Three major items, however, I believe, are worthy of careful consideration. They are:

The mania for "publishing,"
Duplication of effort,
Lack of accessible information.

[1]Reprinted from *The Forestry Chronicle*, Sept., 1933.

Have You "Published?"

Trite, hackneyed, overworked. Unfamiliar a year ago,—maddeningly familiar today. Mention a young research worker in a company of research men, and the question that springs to all lips is, "Has he published?" There appears to be no interest in his personality, capabilities, scholastic attainments or the value of his work. Mention a piece of work in progress, and the inevitable question is, "Have you published?" Number One condones and excuses; Number Two comments, "Aw Hell!" Nor is this imagination. For the past six months I have never missed an opportunity to switch conversation in order to make a test, betting with myself on the result. I haven't lost a bet yet. The last two to bite were the director of an important forest experiment station, and a man who might reasonably be nominated the leading forester in Canada.

The result of this publishing complex is an overwhelming mass of printed matter embodying ideas and experiments half-baked, soggy, and indigestible. I shoo the kiddies out of the way immediately after supper and attempt for a few precious hours to cruise through some of it in hopes of finding a fair stand of merchantable ideas and information. I find nothing much but scrub, the trails lead nowhere and I get hopelessly bushed for the night. The familiar old titles, "Some comments on . ." or "Some aspects of . . . .," confront us at every turn, and in tons of printed matter when information is wanted it can't be found. Perhaps 75 per cent of our forestry papers are waste—waste of time in preparing them, waste of labor and material in printing, and waste in reading. Ruskin said, "A great part of the supposed scientific knowledge of the day is simply bad English, and vanishes the moment you translate it." I believe the old boy was right.

Some months ago I visited a forest laboratory worker who believed he had exploded a theory of considerable commercial importance. Repeated experiments had proved his case, but he proposed to repeat them for a further long period to be quite sure of his ground before making his findings public. This is the refreshing exception which proves the rule. Early in our talk it was on the tip of my tongue to ask him if he had published. Had I actually fallen, I would still suffer chagrin.

Duplication of Effort

There are many phases of forestry, such as administrative problems and certain silvicultural aspects which are of purely local interest; others, such as turpentining, are regional; many phases are of continental interest, or nearly so. Research foresters are largely concerned with basic principles capable of wide application. The rate of forest protection tax levied in the Prairie Province is of no interest to New Brunswick. The results of spruce-regeneration experiments on the Prairies are worthy of very careful consideration by workers along the same line in New Brunswick, Oregon or Massachusetts. Yet, under present conditions, these or any other combination of units may work independently, duplicating each other's work for long periods. I recently heard two eminent foresters quote quite different results in connection with identical studies carried out by their respective organizations. These independent units are prosecuting a study of a factor of importance to Western America. Some months ago, after years of guess and makeshift, we decided it was necessary to develop, if possible, a reliable photometer. The available literature was searched out and, while many experiments were unearthed, none of the results we could find would meet our requirements. A few weeks ago, quite by accident, we discovered that an experiment station in the United States had been working on the problem with

promise of outstanding success. Nothing but the lack of funds saved us from being already well launched on an expensive series of experiments at the time we discovered them to be unnecessary. I recently told "The Chief" that *nothing* had been done along a certain line and that we should be conducting investigations. From the corner of his desk he took a paper from which he read to me a statement of the results of extensive work which had settled the problem on which "nothing had been done." That he should have been familiar with this particular piece of work and have the report on his desk was a pure coincidence, unfortunate for me,—fortunate for our exchequer. That I was unfamiliar with it was a natural result of present conditions.

Such cases of duplication could doubtless be multiplied a thousand times. None of us can be sure that we are not duplicating work being done elsewhere. There are so many problems awaiting our attention, so little money available, and personnel is so limited, that this problem of keeping in touch with current undertakings merits the best thought of the research fraternity.

Lack of Accessible Information

In spite of a veritable avalanche of printed matter, it is impossible for a busy staff to keep in touch with all current developments. Even were it physically pospossible to wade through all that is printed, no research office (fortunately) succeeds in getting copies of all publications. Our mania for publishing doubtless developed in an effort to disseminate useful information, and, lacking any better system, is perhaps necessary in spite of my tantrum. The fact remains, however, that it is not fulfilling its object, and on the subject of current experiments we are more in the dark. Some effort is made in the United States to supply information regarding current projects in published work programs and station reports, but such are incomplete, of limited distribution, and fail to keep research workers in touch with what is being done elsewhere. There follows, as a result of this lack of information, wasteful duplication of effort, individual doubt and half-satisfaction in our daily task, and new publications of work done, but not coördinated with that done elsewhere.

Dean Howe, at the recent Pacific Science Congress, stressed the importance of shaping research programs to a common end calculated to throw light on our major problems, rather than dissipating our resources on isolated and local problems of relative unimportance. Had he not been primarily concerned in his paper with conditions in Canada, he might well have made the same statement relative to North America.

Trade and commerce, banking, habits, and speech may change complexion in various countries, but natural phenomena are no respecters of international boundaries, and scientific research is missing a big bet if it fails to coöperate by confining its efforts within any arbitrary boundaries, or, worse still, if it permits the personal ego of any research worker or his immediate organization to dictate policy or programs.

Accepting Dr. Howe's summing up of what should be our primary concern for the immediate future, his proposed program of coördinated research calls for wide coöperation. To accomplish this there must be a complete and up-to-the-minute dissemination of research data. Whether sectional interest and prejudice can be sufficiently satisfied to accomplish this primary object or not the research organizations are still vitally interested in having complete data immediately available.

This distribution of data would involve:

A reliable bibliography,

Abstracting of current literature,

Advice on research programs.

The bibliography should be world-wide in scope. The project is engaging the attention of the International Union of Research Organizations and we may look forward to having such a bibliography available at some future date.

The abstracting of current literature is a problem distinct in itself. Biological Abstracts at $15.00 a year covers perhaps two-bits' worth of the field. The Experiment Station Record, Ecological Abstracts, Botanical Abstracts and others add their tiny contributions. The JOURNAL OF FORESTRY gives us some very excellent and much appreciated reviews, but by and large we must depend on our own resources for the impossible task of keeping abreast of current literature.

Research programs, apart from the few unsatisfactory items previously mentioned, are still closely guarded secrets. Somewhere, in the interests of economy, efficiency, and forestry in general, there should be available to every research worker a statement of current research projects. I do not advocate here a few thousand additional "Comments on" and "Aspects of." Half-finished studies will be of vital interest to very few men. A statement of projects with a very brief progress report (a few lines), is all that need be published. Further details could be secured by interested foresters from the organization concerned. The calls for such information would be confined to men vitally interested and should not be sufficiently numerous to prove burdensome. Incidentally, this work-program would to a great extent obviate the necessity (or counter the excuse) for much of the present-time premature publication, and would make possible more comprehensive papers and sounder conclusions.

My solution for this set of problems is an "International Forest Research Bureau of Information" for Canada and the United States, supported by subscriptions from forest services, forest schools and forest research stations. One-hundred-per-cent. Participation is perhaps too much to expect, but the interested organizations are sufficiently numerous to offer possibilities without excessive cost.

The object would be to publish a quarterly abstract of current forest literature and an annual statement of research work being done. Items should be classified according to standard library practice and printed on loose leaf or card to permit accumulation by subject and consequent easy reference. Much of the abstracting should be done by volunteers. The work programs and progress reports would be compiled from periodic reports to be submitted by all the organizations involved.

The staff of the Bureau might consist of a director, two or three assistants, and clerical staff. The sale of publications would defray a part of the cost, and the remainder would be raised by membership fees of not more than $250 per year, collected from participating organizations. Many times this membership fee should accrue in savings effected by eliminating duplication of work.

The Bureau should operate under the guidance of some permanent responsible organization, such as one of the leading forest schools, the Society of American Foresters, the Research Council of Canada, the Division of Forest Research at Washington, or, even though not within the present scope of its functions, the recently appointed Associate Committee on Forestry of the Research Council.

The plan is entirely feasible and highly desirable. Its success would depend largely on the choice of director, wide participation, and the burying of petty

jealousy. I look forward eagerly to the day when some such service will relieve me of much of the drudgery, largely fruitless, of trying to keep abreast of current developments, and our organization of uncertainty and waste in its program of investigation.

So much of spleen; and a dream, which I hope some one of more influence than myself will be moved to urge to fruition. I have added my little quota to the avalanche of printed pages. I have done more. I have inducted myself into full brotherhood in the Research Fraternity. I have "published"!

Editorial Note: Only on rare occasions are articles from other publications reprinted in the Journal. Ordinarily when this is done, it is generally assumed, and not without good reason, that the article in question has unusual merit because of one reason or another. "A Research Forester Looks at His Job" is not reprinted for this reason. In the opinion of the writer, this paper has no outstanding scientific or scholastic merit. It is, however, refreshing when a "research forester," whatever that may mean, looks at himself and is amused. It is always refreshing when an individual looks at himself and observes that he is not exactly "God's Likeness." It is doubly refreshing when a "researcher" makes this observation. It is the clever and rather naive facetiousness of this "researcher" that appeals to us, and we are inclined to poke a little of his own fun at the jester.

There are a few statements in "A. Forester's" article which should not go unchallenged. "A. Forester" bemoans the fact that it is impossible to keep abreast with all current developments. Perhaps foresters do not make sufficient effort to keep abreast, or perhaps they are attempting to spread themselves too thin. All too often our research foresters know a little about much. It does not follow, however, that the same amount of effort differently applied might not result in knowing much about a little. Sooner or later research foresters will have to get completely away from the idea that they are operatic or movie star experts in the whole field of human knowledge. The younger age class of foresters have this new concept. Many in the older class are beyond the stage where they can recover from suppression, even after a severe thinning in their far flung reading and still farther flung writing. This does not mean that we should attempt to develop in forestry a group of narrow specialists. It does mean, however, that every research forester, in addition to having a broad and adequate knowledge of the general field, will in addition be able to speak with *authority* rather than freely in the field of his researches. The research chemist, the research botanist, the research zoologist, and all other researchers have long ago come to this stage of development. Why not the forester? A little change in emphasis in our research institutions will go a long way in hastening this change.

"A. Forester" also seems to be alarmed at the emphasis placed on publication. Why shouldn't a forestry investigator, a botanical investigator, or any other kind of an investigator, publish his results? If he hasn't anything to publish, within reasonable limits, he can not be making much headway as an investigator. No, the difficulty is not that we are publishing too many results of research, but rather that we are publishing too much "huey," "bologna" or what have you. The fact that much of this material emanates from research institutions—such as educational institutions and forest experiment stations —does not in the least change its status. Because of the fact that this "huey" is not the result of research, but rather of the lack of it, it can not fall within the scope

of "A. Forester's" consideration. The writer feels rather strongly that we should have more and better research and more and faster publication of the results of research.

"A. Forester" is also rather more optimistic than the writer concerning the efficacy, and probable span of life of an International Forest Research Bureau of Information. When one considers the difficulties enterprises such as *Biological Abstracts*, which appeal to a fairly large group of workers, have had, one can not hold out much reasonable hope for the ultimate success of an undertaking of this sort limited to the field of forestry. As for selling memberships to American universities in such a Bureau—personally I should rather attempt to sell ice to an Eskimo.

HENRY SCHMITZ.

BRIEFER ARTICLES AND NOTES

Down the River

One reads, every so often, that American foresters are beginning to approach something better in the way of forestry than the construction of range fences and scenic roads, and the uninformed reader concludes that: (1) conditions are unfavorable for forestry in this country or have been so until recently; (2) that foresters, perhaps, have been slow to inaugurate intensive forestry practices; or (3) that some one, perhaps the public, has been unwilling to allow foresters to put their knowledge into concrete form in the timber. The reader of such articles should, I suppose, give way to an audible sigh of relief and should imagine that he sees upon the eastern horizon a tinge of rosy light—the coming of the millenium (timber famine, forestry consciousness, or what have you) to which foresters have periodically pointed or for which they have constantly hoped.

A bit of rambling about the drainage of the South Platte River southwest of Denver and on the Pike National Forest is good for the soul of the forestry agnostic, positively dispels any tendencies towards the mere heaving of sighs of relief, either publicly or in private, and displaces the sighs with a feeling of elation that is entirely the result of existing and improving forestry conditions and that has nothing whatever to do with recent liquor laws.

Old forestry activities, well antedating the present CCC and NIRA work, dot the South Platte River drainage with evidences of good forestry practices. The Christmas tree thinnings in Jarre Canon, which used for Christmas trees the surplus trees on over 800 acres of too densely stocked stands of Douglas fir, have been conducted on a paying basis since their inception in 1920. Going southward, to the country north of Woodland Park, one finds many evidences of forestry activities. The Sadler sales around Mount Deception, beginning in 1905-1906, Colorado College's 6,200-acre forest property, managed with ever increasing intensity since 1905, and the Dan Morris sale, which has cut 1,000 acres since 1928, are characteristic of the Trout and West Creek drainages. Woodland Park has been a timber producing town since the railroad came through in the late 80's; the railway yards there constantly receive and ship timber products; all of the national forest and most of the private lands which have been cut over north of Woodland Park are well stocked and productive.

Swinging westward, all of the important drainages have been the scenes of large timber sales. Mule, Rule, Manchester, West, and Phantom Creeks have all been harvested. A large sale was conducted near Signal Butte, on Trail Creek, and in 1931 1,000 acres of burn was replanted on the same creek. Experimental planting was begun on the Skelton Ranch, near Divide, in 1908 and was continued for several years.

On the Lake George District, the Sam Cohen Co. cut over 5,000 acres of timber on Badger, Stoll, and Pulver Mountains, and today when motorists drive over Wilkerson Pass, between the well timbered Badger and Pulver Mountains, few realize that the area has ever been cut over.

Farther west, near Fairplay, 3,000 acres were planted with trees in the years 1929-1932. Some of the first erosion control studies of the region were conducted in the Salt Creek drainage in 1930, and the forest areas above Fairplay and Alma have for years furnished timbers for the mines about the two towns.

On Jefferson Creek, northeast of Fairplay, the Almgren brothers cut over 2,500 acres, and across Kenosha Pass, at the head of the North Fork of the South Platte, the Karagoff sales, begun in 1926, have cut over 3,000 acres.

Then, going down the North Fork of the South Platte River, one enters a region that affords one continuous display of old and modern practices in forestry. The old charcoal kilns at Webster and the timber lands cut to provide wood for them adjoin the thinning done near Grant by CCC Camp F-10 at Bailey in 1933. Forest Service timber sales south of Chaseville Ranger Station have removed much defective and diseased material and are reproducing perfectly. 560 acres were thinned above Shawnee by CCC boys in 1933, and every stick of thinned material was sold within a few weeks after the thinning was finished.

The CCC Camp at Bailey (F-10-C) thinned dense timber areas in Brookside, Payne, Wet, and Crow Gulches and everywhere worked near old timber sales areas, old burns on which the fires were successfully brought under control or near summer homes situated upon national forest lands. The last thinning done from this camp was at Insmont, just across the hill from the 200 acres thinned along the Redskin Road by the Denver wood camps of 1932.

The NIRA camp at Silver Spruce Ranch late in 1933 thinned 1,400 acres south of the Denver wood camp thinning, and the CCC camp at Buffalo Creek started work at the Redskin and Silver Spruce NIRA thinning boundaries and are carrying the thinning eastward, down the river, thinning 5,000 acres from Camp F-31-C. A new road built by the Buffalo Creek CCC Camp during December and January extending down the crest of the ridge between the North and South Forks of the South Platte River, brings the town of South Platte within 10 miles of the ranger headquarters at Buffalo Creek instead of the former 27 miles of car travel, and makes accessible 5,000 acres of an old burn which is to be reforested this spring.

The Deer Creek, Cub Creek, and Jarre Canon NIRA thinning camps, the South Platte River improvement crew, Cheesman Lake, the late Ranger Parrett's old plantations—all furnish evidences of timber culture, timber uses, water and grazing uses. Many that cannot even be listed here.

Buffalo Creek, at which CCC Camp F-31-C is located, is perhaps the geographical center of the forestry activities of the South Platte River drainage, and until but a few years ago was an isolated ranger headquarters reached only by a narrow gauge railroad or by steep wagon roads. Today the recently completed Forest Highway between Manitou Park and Colorado Highway 8 brings Buffalo Creek within two hours' motoring distance of either Denver or Colorado Springs, and brings the promise of even greater forestry activities in this region.

The area I have so briefly described is worthy of a periodic forestry tour, for in few places in this country can one find better or more extensive forestry practices. Over one-half of all the timber stands in this drainage has been cut over, and everywhere the forests have been benefited by the timber harvest and by the cultural work of the CCC and NIRA camps. Best of all, such great forestry activity is not merely the result of fortunate appropriations, nor is it the result of unreasonable requests on the part of those in charge. It is, instead, the result

of public needs and demands in this particular region and of careful planning on the part of the men who have, down through the years, planned the destinies of this forest area.

J. V. K. WAGNER,
Pike National Forest.

"INDIAN FORESTER" CELEBRATES 60TH ANNIVERSARY

The *Indian Forester* started publication in the days of the celebrated foresters, Drs. William Schlich and Dietrich Brandis. Dr. Schlich was the magazine's first editor. The magazine was one of the outcomes of the Allahabad Forestry Conferences of 1873-74, and was published first as a quarterly; since 1883 it has appeared monthly. A large share of credit is given to B. H. Baden-Powell upon whose initiative the conferences were called and who was a prolific contributor to the earlier numbers.

It is worth while to quote Dr. Schlich's policy statement from the Prologue to the first volume:

"Our object is to supply a medium for the intercommunication of ideas and the record of observations and experiments, as well as to catch all stray fragments of information, all facts and data, and supply the places of 'Notes and Queries' to the Forest Service generally.

"As to our principles, they are decidedly liberal and independent. We, and all who communicate with us, are free to express what we think; we shall not repress any criticism on what we honestly believe to be wrong, or say anything that we do not believe to be true, to please any one. We shall endeavor to extenuate nothing, and we shall 'set down nought in malice.' But free, full and unfettered discussion of every principle and practice is the very life of forest science and forest art.

"That discussion it will be our endeavour to facilitate with all the means at our disposal. But this thing we will do—we will impress on ourselves and our contributors the absolute maintenance of courtesy and good temper in the thick of the hottest discussion, and we will banish from our pages every thing that verges on personality or harshness of expression. Our criticism will be directed to measures, not men, to the opinions and utterances of the impersonal office, not to the thoughts and deeds of individuals.

"In pursuance of the general principles enumerated we do not propose to open our columns to personal grievances; but questions affecting the organization of the service, or a section of the service, are legitimately within our scope. We propose to allow ourselves the option of declining papers which are unsuited for publication, or which are based on absolutely unscientific grounds; but we trust that the exercise of this discretion will rarely need to be called into action.

"We have now earnestly to address our supporters in behalf of this new scheme of an Indian forest periodical. Above all we want steady contributors. Now many forest officers feel, and naturally so, that they have no time for writing. Others feel that they have no facility with the pen, and perhaps too modestly imagine that they can do nothing to help. With regard to this feeling, we would offer a few remarks. In the first place, while every number ought to contain a fair proportion of leisurely-written and detailed matter, that share of the work must necessarily be handed over to those who have a gift for writing, and who have the necessary literary machinery in the shape of books of reference to assist them. But the only value of a periodical of this sort will not consist in its containing elaborate essays. A large portion of it should be devoted to 'Scraps' and to brief 'Notes and Queries.' Every forest officer who is worthy of the name keeps a note-book,

and as some new fact or some new experience comes to his notice, or some 'happy thought,' tending to the facilitation of some portion of his work, flashes across his mind, he will make a rough note of it. There is actually no one who can go about from day to day on plantation work, up and down a river on timber transport business, demarcating a forest, making valuation surveys, or engage in any other branch of his ordinary business, but must see something, and learn something, which is in itself valuable, and a distinct addition to the stock of facts whch are the basis of all rational and practical progress in forest administration."

Dr. Schlich's statement is interesting from several angles. It sets up a policy for a magazine intended primarily to be useful to the man in the field and it indicates that 60 years ago the editor saw as his principal problem the obtaining of suitable and sufficient material for publication, the same problem that besets editors everywhere today. The *Indian Forester* has been eminently successful in living up to its first editor's plan and policy and it is today regarded by foresters in the region to which it applies as outstandingly useful. It not only provides the 15,000 or more foresters in India and Burma with helpful information for the conduct of their work but it champions their professional interests and welfare. Its back volumes gives an interesting history of the trials and successes of forestry in India, and present an enviable record of unflinching loyalty to its aims, interest, and progress.

The January 1934 number is the first of the 60th volume, and while a large share of this special and double number is devoted to anniversary notes and felicitations, there is the usual amount of space for other articles of such types as forestry descriptions in other British possessions; a travel article; articles on dendrology, timber framing joints, termite control, thinning out shoots on young root stocks, etc. Not the least useful department is that of Reviews. The forester in India is here given an excellent survey of the world's literature of value to Indian forestry.

Indian foresters appear to be much concerned that the plan to provincialize the Indian Forest Service will cause the decline of forestry. Whatever the outcome, it is to be hoped that they will continue the *Indian Forester* as their common forestry journal for all provinces.

EMANUEL FRITZ,
University of California.

PACK FELLOWSHIP AWARDS

Making its fifth annual award of fellowships for training leaders in forestry, the Charles Lathrop Pack Forest Education Board announces its selection of five Americans and one Canadian for the year 1934.

The fellowships were established to encourage outstanding men to obtain advanced training to better qualify them for leadership in forestry and in the forest industries. The "New Deal" in forestry has committed timberland owners to initiating forest management throughout the United States, and realizing the need for practical knowledge as to the best methods to be pursued, the Board awarded two of its six fellowships to projects undertaken in this field.

The successful candidates are:

G. S. Andrews (Canadian), Junior Forester, British Columbia Forest Service. To make studies in air survey and aerial photogrammetry as applied to forestry.

Ellery A. Foster, Technician, E.C.W., U. S. Forest Service. To make an investigation of the financial aspects of curtailing production in the hardwood forests of the Lake States, as provided in the National Industrial Recovery Act, with

special reference to the possibilities of sustained yield management under a system of selective cutting.

Neil W. Hosley, Instructor, Harvard University, Harvard Forest. To do one year's investigative work in fish and game management.

R. R. Reynolds, Junior Forester, U. S. Forest Service. To make a study of the costs of selectively logging varying volumes from second-growth timber stands in the shortleaf-loblolly pine-hardwoods types and study of possibility of reducing logging costs in selectively logging light stands.

Paul W. Stickel, Associate Silviculturist, U. S. Forest Service. To make a study of the bark character of trees in relation to their resistance to fire injury.

Allen S. West, Jr., Graduate student in forest entomology, Yale University. To continue investigations on the biology and control of the European pine shoot moth.

This is the fifth award of fellowships by the Charles Lathrop Pack Forest Education Board. The fellowships are available to Americans and Canadians for further training in the general practice of forestry, in the forest industries, in the teaching of forestry in forest research, or in the development of public forest policy.

The Directors of the Board are: Henry S. Graves, Dean, Yale Forest School, Chairman of the Board; Samuel T. Dana, Dean, School of Forestry and Conservation, University of Michigan; John Foley, Forester, Pennsylvania Railroad; William B. Greeley, Secretary-Manager, West Coast Lumbermen's Association; Arthur Newton Pack, Director, Charles Lathrop Pack Forestry Trust; E. O. Siecke, Director, Texas Forest Service; Ellwood Wilson, Acting Professor of Silviculture, New York State College of Agriculture; Hugo Winkenwerder, Acting President, University of Washington; and Raphael Zon, Director, Lake States Forest Experiment Station.

The offices of the Board are at 1214 Sixteenth Street, N. W., Washington, D. C.

Louisiana State Forestry Department To Be Developed

Statisticians and land classifiers estimate that about nineteen million acres of land in Louisiana out of the total area of twenty-nine million are forest land. Assuming that these estimators have made an error of some six million acres, which is suitable for agricultural purposes, this still leaves from twelve to thirteen million acres that is primarily suitable for reforestation and forestry purposes in general. With these facts in mind, forestry then looms up as a most important program to be considered in the utilization of a large amount of land of the state. What is true of Louisiana is true practically of every other southern state, and of course, is applicable to lots of the states in the northeastern and northwestern part of this country.

With these facts staring the officials of the Louisiana State University in the face it was decided that the forestry department of this institution should be developed and put on a high plane of efficiency. This is necessary if the institution is going to serve the people of the state and the people of the south as they have a right to expect and demand. With this idea of service in mind the institution has made a good start in employing Professor Ralph W. Hayes to head the Forestry Department.

Professor Hayes received his Bachelor's degree from Iowa State College in 1914 and his Master's degree from the same institution in 1924. He worked for the federal government, Department of the Interior, in its forestry work from 1914 to 1924. He was employed by the Colorado

Agricultural College, Department of Forestry, from 1924 to 1926. From 1926 to 1929 he was employed by the Louisiana State University, College of Agriculture, Department of Forestry, as Assistant Professor of Forestry. He has been a Senior member of the Society of American Foresters since 1928.

In 1929 he left the University of Louisiana and was employed by the North Carolina State College, Department of Forestry, and served there as Professor of Forestry until April 1, 1934, when he returned to the Louisiana State University to head the department at that institution. Professor Hayes was employed by the Southern Forest Experiment Station during the summers of 1926, 1927, 1928, 1929, and 1930.

The administrative officers of the Louisiana State University are solidly behind the development of forestry in Louisiana and are desirous of making the department one of the best in the country, and to that end, they are backing Professor Hayes and his co-workers in the development of this work.

Color Variations in Ponderosa Pine Oleoresins

An experiment with resin flow from "blackjack" ponderosa pines in southern Idaho resulted in the yield of a green gum. This gum was pronouncedly green in color, even from its first experience on the turpentine face, and was in sharp contrast to the gray-white product of the flow from most of the other trees worked in this experiment. This variation in gum color occurred even under apparently homologous conditions; there appeared to be no relationship between such factors as type of face, size of tree, exposure of slope or injury by fire. All of the trees cupped were young ponderosa pines, tree class number two under the classification proposed by Duncan Dunning.[1]

An investigation of the physical and chemical constants of the green and gray-white oleoresins, as well as a study of their properties, was conducted by Corland L. James, under the direction of Dr. Edwin C. Jahn of the wood chemistry laboratory of the University of Idaho Forest School. This examination indicated that the properties of the two oleoresins were not identical, although in most instances the points of difference were relatively small. However, a variation in the acidity and in the optical rotation of the two gums was reported, and it was found that the volatile oils of the green and gray-white oleoresins, as well as a study of tain definite chemical and physical differences.

A further study of the two specimens by Dr. Julian Miller, of the School of Botany, University of Georgia, conclusively showed the pigmentation of the green oleoresin to have been brought about by the presence of green algae appearing in the crude resin when the tree was being bled for its gum. The metabolism of these green algae might possibly account for the differences in physical and chemical properties of the two oleoresin color types.

Wm. P. David,
Southern Forest Experiment Station.

Progress in Federal Forest Acquisition

Lands within national forest areas totaling 154,420 acres were approved for purchase by the National Forest Reservation Commission at its meeting on March 26.

[1] A Tree Classification for the Selection Forests of The Sierra Nevada, 1928. Jour. Agri. Research, 36:755-771.

The tracts lie within purchase units east of the Great Plains, about one third in the Lake States, one third in the Appalachian region, and most of the remainder in the Ozark and Central Mississippi, and the Southern Pine regions. Small acreages in New England were also approved. The average price per acre for all purchases was $2.97.

Establishment of 13 new national forest purchase units and enlargement of 13 existing units in 10 of the states east of the Great Plains, was also approved. The gross area of the approved new units and additions is more than 7,300,000 acres but it is expected that more than 1,000,000 acres will remain permanently in private ownership and that purchases in these areas will not exceed 6,127,000 acres. This action was taken when the Forest Service reported that purchases in existing purchase units were not proceeding rapidly enough to consummate the scheduled acquisition of about 8,000,000 acres under the President's conservation program inaugurated last spring.

Since the allotment of $20,000,000 for this purpose 3,233,862 acres east of the Great Plains have been approved for purchase. Although millions of acres of forested and cut-over lands are tax reverted and tax-delinquent, a great deal of the land in purchase areas already established has beeen held at prices the Forest Service could not justify. Instead of closing for lands at unwarranted prices it seemed preferable to create new purchase opportunities in other sections where the need for forest conservation is equally great. With approval of the new areas, the Commission expects the purchase program requirements can be met readily at prevailing prices.

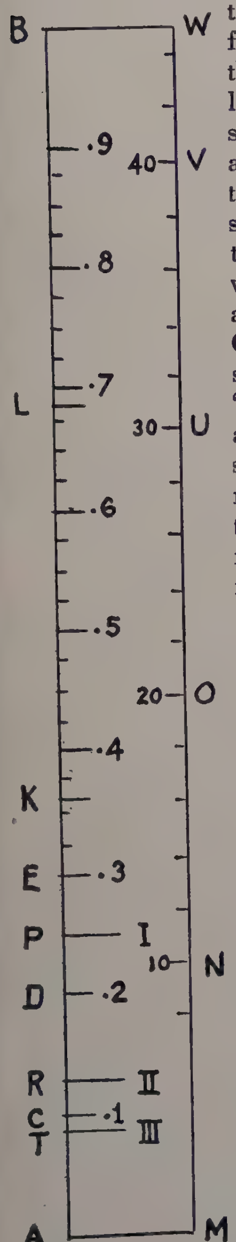
The new purchase units thus approved include 1,400,000 acres in eastern Texas; 1,677,840 additional acres in Missouri; 1,500,000 acres in the Piedmont region of North and South Carolina; the Croatan Unit in the Coastal Plains of North Carolina; 382,000 acres in a region of serious erosion near Meridian, Mississippi; and a new unit in Puerto Rico of 35,000 acres, the Toro Negro.

Appreciating the desirability of having within the national forests an adequate example of the redwood type of forest, the Commission indicated that if the Forest Service could find a suitable area of redwood obtainable under conditions equitable to the public the Commission would be willing to consider its purchase.

The National Forest Reservation Commission will probably hold its next meeting the first part of May.

A Hypsometer for Woodsmen

Many woodsmen, particularly cruisers, have always wanted a simple and reliable device for measuring heights of standing trees with the least effort. The nature of their work requires light, inexpensive instruments, free from any adjustments and the necessity of measuring horizontal distances. Furthermore, very often estimates are made occularly. One needs some speedy way to check "the eye" as he goes along. Should the instrument be bulky or require time for setting or manipulation, it will be rarely used for this purpose.



The hypsometer shown in Figure 1 has been designed to answer these specifications. It is a wooden stick 12 inches long, 8/10 inch wide, and 2/10 inch thick, with a series of graduations stamped on it. This particular size was found to be most convenient for the general run of timber in the Lake States. The graduations are based on the principle of proportions previously described by the writer in the article entitled "The Use of Canes by Foresters" (Jour. of For., Dec., 1928, Vol. XXVI, No. 8, p. 1064). The cost of making this hypsometer is next to nothing. The graduations can be readily stamped on a straight strip of wood, using the following proportions: (See Figure 1) AC = 0.1 AB; AD = 2 AC; AE = 3 AC, etc.; AK = 0.36 AB; AL = 0.68 AB; AP = 0.246 AB; AR = 0.13 AB; AT = 0.09 AB; MW = AB; MN = 0.222 AB; MO = 2 MN; MU = 3 MN, etc. The theory of these simple proportions requires hardly any explanation. It will be better understood from the following instructions for the use of this stick. Once the application of the stick is understood and the user acquires a little experience, it gives quick and surprisingly accurate results.

To estimate total height of tree, or height to any point on the stem

General.—(Recommended for trees 45 to 70 feet in height). Select a position where the entire tree can be observed, preferably at a distance equal approximately to the height of the tree. Hold the stick lightly between the thumb and forefinger and let it hang by its own weight. Move it toward or away from the eye until the line of sight through the lower end of the stick (AM) cuts the base of the tree and that through the upper end (BW) cuts the tip of the tree. Quickly note the point at which the line of sight through the .1 graduation on the stick (c) strikes the tree. Measure or estimate the height of this point above ground and multiply by 10 to obtain total height. If two men are available one can slide his hand up and down the stem of the tree and thus help the instrument man in determining the .1 point, thereby insuring greater accuracy. If AC on the tree trunk measured 5 feet, then the total height of the tree is 5 multiplied by 10 or 50 feet: repeat the measurement a few more times to eliminate chance errors.

Short trees.—(Recommended for trees

below 45 feet in height). Pass first line of sight through lower end of the stick (AM) and base of tree. Pass second line of sight through .1 graduation on stick (c) and d.b.h. point on tree. Quickly note the point at which the tip of the tree cuts the stick. Read the graduation of the stick (scale AB) and multiply this value by 45 to determine total height of tree. The same may be also obtained directly on the scale MW. This scale reads height in feet directly.

Very tall trees.—(Recommended for trees over 70 feet in height). Select some distinct mark on the tree, such as a branch, a dry stub, or the base of crown. Pass the first line of sight through the lower end of the stick (AM) and the base of the tree. The second line of sight should pass through the upper end of the stick (BW) and the tip of the tree. Note the point at which the chosen mark (branch or stub) cuts the stick. Read the graduation (Scale AB) and remember it. Next, estimate the height of the observed mark above ground as outlined in paragraphs A (a) and A (b). Divide the height thus obtained by the figure previously determined. This gives the total height of the tree. If for example, the height above ground of the observed mark happens to be 48 feet and if this height represents 60 per cent of the total height of tree (0.6 on the scale AB), then the total height of tree is 48 divided by 6/10 or 80 feet.

TO ESTIMATE NUMBER OF 16-FOOT LOGS (STUMP HEIGHT 2 FEET)

In order to determine the point where top of first, second, or third log comes on the tree stem, first pass line of sight through lower end of stick (AM) and base of tree. Pass second line of sight through the log-length mark—for example, the two-log mark (Roman II or R) and then through the d.b.h. point on the tree. Move toward or away from the tree to accomplish this. The line of sight through the upper end of the stick (BW) will then cut the stem at the top of the second log. To determine top of first or third log follow the same procedure except use the log length mark for one log (I) or three logs (III).

Another way may also be suggested. Place a mark on the tree trunk 5 feet and 1 inch above the ground. Move away from the tree until the first line of sight can be passed through the lower end of the stick and the base of tree, and the second line of sight through the .1 graduation, and the mark already made on the stem (5 feet and 1 inch above ground). Continue to hold the stick in position. The top of the first log will come at .36 on the stick, the top of the second log at .68, and the upper end of the stick will cut the top of the third log.

S. R. Gevorkiantz,
Lake States Forest Exp. Sta.

Fast Growing Redwood

Even in the redwood region, noted for its high annual timber yields, a very optimistic estimate as to maximum sustained growth could have fallen short of the growth made by a stand recently measured in Mendocino County. This stand occurs directly east of Ft. Bragg, 15 miles from the coast, on a small flat at a fork of Marble Gulch that drains into Noyo River. In 1933, its average age was 260 years and its volume per acre, estimated by the International rule, was 776,600 feet b.m.; thus its annual growth had averaged 2,987 feet per acre. As shown by ring counts on stumps, growth was much faster during the

first 150 years than later. The mean annual growth during the first 100 or 150 years was probably between 3,500 and 4,000 feet per acre.

These values are not estimated but based on actual measurements upon a 0.661 acre plot laid out in the summer of 1933 in the best part of this stand the whole of which occupies about an acre. On this plot all of the trees were tallied by diameters and crown classes, and a sufficient number of heights were measured to permit drawing a height-on-diameter curve. Diameters of dominants and codominants varied from 37 inches to 80 inches, averaging 50.6 inches. Their heights averaged 256 feet. The largest tree was 80 inches in breast-height diameter and 270 feet tall. The average representation of tree classes, in number of trees per acre, was as follows: Dominant and codominant, 59.0; intermediate, 13.7; suppressed, 16.7.

It is interesting to note that this same area supported a heavy stand of redwood many years ago. During recent years one of the forks of Marble Gulch shifted its course and cut a new channel about 6 feet deep through the middle of the flat that supports this stand and this channel exposed portions of tree trunks of a former forest underlying the roots of the standing trees. It is probable that sometime in the past an obstruction in the stream channel caused the area to be flooded and the stand of that period to be killed; then after several feet of soil had been deposited over the fallen trees the cause of the flooding was corrected by the washing away of the obstruction or the cutting of a channel around it and the stream then cut down to or near its original level, thus again providing an exceptionally favorable site for growth of redwood. The present stand apparently reseeded in over a period of 50 to 80 years.

William Hallin,
Calif. Forest Exp. Sta.

Southern California Association of Foresters and Firewardens Meets

The Southern California Association of Foresters and Firewardens held its annual meeting at San Bernardino, March 2, 3 and 4, 1934, with an attendance of over 200 members, many of whom are active members of the Society of American Foresters.

In the papers presented and the discussion following them, much attention was given to the C.C.C. work in its relation to fire prevention and erosion control in Southern California.

Officers elected for the coming year are: Spence D. Turner, President; S. A. Nash-Boulden, First Vice-President; Luther C. Gordon, Second Vice-President; Guerdon Ellis, Treasurer; and J. E. Pemberton, Jr., Secretary.

Penn State Holds Farewell Banquet

In the Nittany Lion Inn of State College, Pa., on March 26th, one of the milestones in the lives of the Penn State senior and two-year ranger foresters was set in place. A banquet, denoting the passage of another graduating class of Penn State foresters into the bright present and the prospective future, was given to mark the occasion. Optimism and good feeling were the keynotes of the affair and accounted for its most enjoyable success.

In all 150 were served, 35 of whom were guests. Among those who spoke were: Dr. R. D. Hetzel, President of the Pennsylvania State College (who acted as the official representative of the college in complimenting the graduates upon their accomplishments and wishing them success in the future); Mr. F. W. Reed, Executive Secretary of the Society of American Foresters; Mr. John W. Keller,

Deputy Secretary of Pennsylvania's Department of Forests and Waters; Dean Watts, Dean of the School of Agriculture; Mr. J. A. Ferguson, head of the Pennsylvania State Forest School; Mr. H. N. Cope, in charge of the Mont Alto Division of the Pennsylvania State Forest School; and Mr. C. M. Meek, Pensylvania Extension Forester.

The announcement in one of the speeches that the two highest marks given in the last Civil Service Exam were given to two graduates of Penn State won admiration and praise from all those present.

LOUIS W. SCHATZ, '34,
Pennsylvania State.

OCCURRENCE OF THE STRUMELLA DISEASE IN THE MIDWEST

The Strumella disease of hardwoods, which has attracted considerable attention in the Middle Atlantic and New England States in connection with stand improvement activities under the Emergency Conservation program, has been found recently in Minnesota. Previous records of the occurrence of the disease in the midwestern section of the country have been lacking except for the collection of the fungus *Strumella coryneoidea* in Missouri.

Large Strumella cankers and fruiting bodies of *Strumella coryneoidea* were found on the trunks of red oaks (*Quercus borealis maxima*) during the fall of 1933 in an extensive hardwood stand located in Rice County, Minnesota. Diseased trees were found scattered throughout the stand, and it is probable that a thorough examination will show a general distribution throughout the broadleaf deciduous region of Minnesota and adjoining states. The occurrence of aged Strumella cankers in the midwest appears to lend support to the conception that the disease is either a native of North America or has been present for a considerable period of time during which it has become widely spread over the northern and central broadleaf deciduous region of the United States.

While it is not expected that the disease will become epidemic under normal conditions, its frequent occurrence on otherwise healthy trees and the resulting decrease in the productivity of infected stands makes it a factor to be taken into account in future cultural treatment of hardwood stands in the midwest. The removal of a major portion of the hardwood stands in the region has made the remaining wooded areas important to the farming population as a source of forest products for local farm use and for firewood, in addition to its aesthetic value. Proper silvicultural cutting methods are sorely needed to retain the productivity of the remnants of the hardwood forests of the midwest.

WILLIAM C. BRAMBLE,
Carleton College.

FOREST SERVICE ESTABLISHES NEW FOREST REGION

The Forest Service has announced that, effective July 1 next, a new national forest region will be established by division of Region VII, which now embraces all states containing national forests in the eastern and southern parts of the country.

The new region will be known as Region VIII and will embrace all the states south of and including Kentucky, Tennessee and North Carolina and extending west to include Texas and eastern Oklahoma. The headquarters of the region will be in At-

lanta, Georgia, and regional forester will be Joseph C. Kircher, who has been in charge of the eastern national forest work for the past several years.

The region embraces the New England states, New York, New Jersey, Pennsylvania, Kentucky, Virginia and West Virginia will form a separate region to be known at Region VII. Headquarters will be at Washington, D. C., and R. M. Evans, who has been assistant regional forester in charge of forest management, has been designated as regional forester.

Errata

In the March, 1934, issue of the Journal, page 357, the following correction should be noted, in the review of The European Pine Shoot Moth: Allen S. West, Jr., should be listed as co-author with Roger B. Friend.

On page 353, March, 1934 issue of the Journal under "Erratum," it should read "In the January, 1934," instead of "In the January, 1933."

REVIEWS

The Relation of Certain Soil Characteristics to Forest Growth and Composition in the Northern Hardwood Forest of Northern Michigan. By R. H. Westveld. *Tech. Bull. No. 135. Michigan Agr. Exp. Sta., East Lansing, Michigan.*

This is a study of soil and forest relationships in that part of Michigan north of a line drawn from Saginaw to Muskegon. Six million acres of northern hardwoods from a total of 19 million acres of forest land comprise the area in which this investigation was made.

Proceeding from the major premise that soil characteristics are relatively unchanging and that they may be determined irrespective of forest types existing at a given time and that soil factors offer in cases of cut-over land, the only accurate measurable variable, the author proceeds systematically and logically to determine the effects of soil variables on virgin woods and finally to project this information into bases for land evaluation and reforestation.

Following a review of the literature, he describes the region in which he shows that length of growing season is the only important climatic variable.

For growth studies ½ acre plots were selected. Small areas were used to avoid irregularity, and by so doing, it was possible to secure 85 to 90 per cent stocking. Heights and diameters of 10 to 15 dominant trees in each plot furnished data for height-diameter curves.

Increment borings were taken where practicable. In most cases because of large diameters with very hard wood, it was found impossible to secure ages. The plots were composed largely of old trees; hence the conventional site index based on height at a definite age was not feasible. However, since the stand was old-growth and the heights of the dominant trees fell on the flat part of a height-age curve, it was found practical to assign site index on the basis of average dominant height. A series of heights and ages determined on felled trees furnished the basis for this procedure.

Since sugar maple was the most abundant species, and its average height varied little from the average dominant height of all species, this tree was taken as the criterion of site quality.

Abnormal plots were eliminated on the basis of percentage deviation of actual basal area from the basal area of 10-inch and over trees. The author found that the total basal area of 10-inch diameters and over furnished the best criterion of stocking. This eliminated the increase in basal area caused by a large number of very small diameters, and thereby put comparisons on the basis of dominant trees which in the case of an equilibrium such as one finds in an old-growth woods, is the most reasonable measure of site.

Twenty-three soil types were recognized and studied. In the phase of the study dealing with the relation of forest composition to soil, strips 15 to 20 chains long and 1 chain wide were used. To avoid possible soil variations, he recorded each square chain separately.

On the basis of height of dominant stand, three site index classes were recognized: 70, 80, and 90 feet average height at maturity. Arbitrarily, three classes, 65.6 to 75.4, 75.6 to 85.4, and 85.6 to 95.4 were used in classifying plots.

In the treatment of growth and yield in relation to site, the author makes the following comparisons, using site index as the base:

1. Number of trees in dominant stand.
2. Number of trees 10 inches d.b.h. and over.
3. Basal area in square feet.
4. Entire stand volume in feet board measure.

He found that some species, such as basswood and American elm, showed a greater response to differences in site than did other species.

Composition influenced yield. Elm and basswood in the composition increased yield, whereas beech decreased it. Yellow birch had little or no influence.

Perhaps the most significant part of the paper was the relationship the author found between certain groups of soils and site index. An analysis by individual soil types seemed somewhat questionable, or at least not conclusive; but when the soils were grouped on the basis of general properties, such as drainage, depth, and character of subsoil, better correlations were apparent. This fact, to the careful observer emphasizes the necessity of basing research on fundamental data.

It is gratifying to see here a recognition of basic ecological relationships. Studies of growth are of value only to the area examined, unless the underlying fundamental factors are found. Research in forestry or any other science must of necessity have as its basis fundamental research rather than empirical unrelated data. Westveld has recognized this fact and found the growth influence by grouping his soils on the basis of general ecological factors.

It is impossible to cover the bulletin adequately in a short summary. It is recommended as an example of a logical approach to a complex forestry problem.

JOHN T. AUTEN,
Central States Forest Exp. Sta.

Inheritance of Witches' Broom Formation in Pine (*P. sylvestris*). (Vererbung der Hexenbesenbildung bei der Kiefer). By J. Liese, Eberswalde, *Zeitschr. für Forst.—und Jagdwesen, Vol. 56, No. 10, Oct., 1933.*

By witches' broom formation is meant that phenomenon in which a branch system of a tree undergoes a significant metamorphosis that manifests itself in subnormally shortened internodes and a concomitantly bushy growth and results in a more or less diminished rate of subsequent growth. In addition, the new twigs very often exhibit a tendency to react independently of the normal correlative tropisms of the tree; they usually attempt collectively to grow vertically upwards, or occasionally extend themselves in all directions from the parent branch, exhibiting no discernible gravitational influence.

We are very well informed concerning the causes of witches' broom development as in very recent times, Prof. Baron von Tubeuf, who has worked with this problem for a long time, published a thorough-going contribution on the subject (Zeitschr. für Pflanzenkrankheiten and Pflanzenschutz. (Pflanzenpath.) Vol. 43, 1933, pages 193-242). According to Prof. Tubeuf, most of the indigenous witches' brooms are traceable to parasitic influences, among which fungi, next to mites, are most important. Among the witches' brooms of the deciduous tree species, the Exoascus species rank at the top. The witches' broom of silver fir (*Abies pectinata D C*), which simultaneously produces at the point of infection the so-called silver fir canker, also is caused by a fungus (Melampsora Caryophyllacearum).

But for a long time the problem as to the cause of spruce and pine witches' brooms remained unsolved since fungous and other parasitic irritators were not

found and evidence that tended to prove the contrary was refuted upon counter-investigation. Von Tubeuf first succeeded in establishing the fact that spruce witches' brooms were occasioned by growth modifications induced by internal disturbances. He succeeded, at three different times, first in 1907 and twice through repetition of the experiment in 1930, in producing progeny from the seed of spruce witches' brooms which developed, to the extent of 27.7 and 38.5 per cent in the last two experiments, the same bushy, witches' broom-like growth. Thus the proof of transmissibility was indisputably established and the witches' broom phenomenom in spruce is to be classified, therefore, as a bud mutation.

It was assumed that the same explanation as to the development of witches' brooms was applicable in the case of the pines, although the evidence of precise experimentation was lacking. The reason for the latter lay in the fact that cone bearing witches' brooms in pine were none too frequently available to the scientific investigator; the significance of experimentation in this field was little known to the layman. In response to a request some cones taken from pine witches' brooms were supplied me about three years ago by Diplomforstwirt Baron von Werthern of Hoppenrade. The number of cones was limited and they were small in size and yielded only a few seeds. In addition, in the raising of the seedlings several were lost when attacked by *Moniliopsis Klebahni*. Nevertheless, it was possible to save eight plants for further study. Among these an appreciable difference in the growth habit was recognizable even in the two-year-old plants and during the third year this difference was still more pronounced. Three of the plants exhibited the normal growth habit of the pine, but the other five developed quite completely the witches' broom habit of growth. In both similarity and variations of development there is a striking uniformity between the plants which checks with what von Tubeuf pointed out in his last publication on spruce. No doubt can exist, therefore, that in the case of pine as well as spruce, the abnormal witches' broom habit of growth is to be considered as a mutation and is transmissible to the offspring; that not all of the progeny are of the witches' broom type can be readily attributed to the fact that nothing is known of the origin of the pollen and, therefore, of the masculine progenitor. It is very likely that most of the pollen comes from staminate flowers that grew on normally developed branches. It is remarkable, therefore, that in this experiment considerably more than one-half of the pines are of the witches' broom type.

Essential differences between the healthy and witches' broom pines occur also in the development of the root system. This is evident when entire root systems of 2-year-old normal and witches' broom pines are compared. In every respect, the root development of the witches' broom pines is inferior to that of the normal pines.

As is well known, and as the numerous photographs that illustrate von Tubeuf's work so excellently depict, witches' brooms of pine, as well as spruce, exhibit no uniformity in their development. There are to be found witches' brooms, recognizable as such from a distance, with unusually dense branches; on the other hand there are also "brooms" whose shape, as compared with that of normal branches, show only minor variations and the question may well be raised whether or not a witches' broom condition is involved. While typically dense witches' brooms, as a rule, very rarely bear cones, which necessarily limits the possibility of the transmission of this particular habit of growth, the lesser developed "brooms" are much more prolific cone bearers, and are thus more

abundantly represented in the reproduction through the seed produced by the diseased trees. To what extent the stunted growth habit is transmitted by the latter kind of witches' brooms is not yet known, neither is it known as to whether or not the percentage of representatives of off-spring is less in cases of this sort. On the other hand, it is well known to every forester who has worked in a pine forest that in artificial plantations individual plants quite often remain stunted in form and never develop normally; as a rule they subsequently die off. Heretofore, it has been the practice to attribute such development to parasitical influences and not to ascribe to it any particular significance. Further investigations on witches' broom pines are necessary to clarify this phenomenon. It will also be interesting to study the off-spring of normal branch systems of pine trees infected with witches' brooms, to see if there exists in these likewise a definite tendency toward witches' broom mutations that is, in part, inheritable by the off-spring.

It may be possible later to provide definite information along this line since additional breeding experiments are now under way, in which the seeds from cones of less typically developed witches' brooms have been used. In any event, it will be appreciated if, in the meantime, mature cones from pine witches' brooms are forwarded to me accompanied by precise descriptions as to the size and density of the "brooms" from which the cones were obtained.

ADDENDA

The conclusions of Dr. Liese are sustained by T. J. Hintikka in a contribution entitled "Muutamia haraintoja männyn tuulenpesista (Contribution to the knowledge of witches' brooms in pine)" appearing in Acta Forestalia Fennica, Vol. 39, 1933. The conclusions derived by Hintikka from his studies, which were presumably conducted independently and without knowledge of those of Liese, are:

1. The development of witches' brooms in pine (*P. sylvestris*) is an inheritable characteristic to the extent that certain trees raised from the seed of witches' broom cones manifested witches' broom-like growth.

2. In this witches' broom development a very definite nanistic tendency is displayed, so that one is justified in interpreting the development and formation of witches' brooms in the pine as nanism.

J. Roeser, Jr.,
U. S. Forest Service.

Calculation and Interpretation of Analysis of Variance and Covariance. By George W. Snedecor, *Collegiate Press, Inc., Ames, Iowa, pp. 96, 1934. $1.00.*

Research foresters who are interested in these statistical tools of R. A. Fisher, especially those with but little formal statistical training and those who find the original author's writings on these subjects a bit abstruse, will welcome the simplified presentation in this handy desk manual by Snedecor.

Since Fisher introduced these methods, they have been used by research workers throughout the world.

Theoretically, the analysis of variance is a method of separating the total variation in a population of data into two major classes—chance variation (experimental error) and systematic or significant variation. In addition the systematic variation is broken down and either partitioned to the factors with which it is associated; or, if known a priori, irrelevant systematic variation, such as that due to soil differences in field plot experiments, is nullified by experimental design. Since the sum of the variation from

these different sources must add to the total variation in the sample, a measure of variation is necessary that can be added. Standard deviations cannot be added directly, but their squares can be totaled. Fisher, therefore, used the square of the standard deviation as the measure of variation. This he called the variance. Practically, the analysis of variance is merely an extension of the well-known test for testing the significance of the difference between means of large samples. It can be used for testing the significance of the differences of several means in large samples; but is especially adapted, by the use of degrees of freedom, for testing the significance of several means from small samples.

The analysis of variance detects the presence or absence of systematic variation in a sample of data. On the other hand, the method of covariation measures the degree of this systematic variation, and gives as its end products the well-known simple coefficient of correlation and regression equation. The method of covariance is especially adapted, through the use of degrees of freedom, to small samples; and to data involving both quantitative and qualitative variables.

These methods are based not only on the assumption that the variation within classes is constant and normally distributed, but also that the involved relationships are linear. Slight skewness, however, apparently does not introduce an appreciable error.

The dual subject obviously divides the book into two major parts—the analysis of variance which makes up about 90 per cent of its pages and covariance the remainder, or 10 per cent.

Snedecor develops these subjects in the same simple and logical way i.e., from the simple to the complex—that he and Wallace used in their Correlation and Machine Calculation. In both sections, he first takes up the application of these methods to data involving only one independent variable or, as he calls it, "a single criteria of classification" and then in turn takes up the application two criteria and finally three or more. Furthermore the examples are so chosen that they also illustrate the variations in the method necessary to deal not only with data having one or more than one observation in a sub-class, but also data with equal or unequal numbers in these classes.

The book is essentially a computers manual and in this respect serves its purpose very well. Numerous examples, from a large number of fields, are used to illustrate and explain the principles involved. For each example, the author not only gives the detailed computing steps, but he also discusses fully the principles involved in these computations. Furthermore he discusses the theory of the design of each experiment and the interpretation of the results.

To the best of the reviewers knowledge, this is the only American reference in which both these methods are brought together in one volume and not only fully discussed in a simple style, but also illustrated by examples drawn from many scientific fields.

Those research foresters who are interested in these methods will find this book invaluable.

R. M. Brown,
University of Minnesota.

Testing and Selection of Commercial Wood Preservatives. By S. Kamesam, Officer in Charge, Wood Preservation Section, Forest Research Institute, Dehra Dun. *Forest Bulletin No. 81, Economy Series, 40 p. Price 1s.6d.*

Kamesam's Bulletin, "The Testing and Selection of Wood Preservatives," is of

greater interest in America to technical and scientific workers on wood preservatives than to those actually engaged in the commercial treatment of wood.

In order to properly evaluate Kamesam's work, it is necessary to regard it from the proper perspective. In his preface, Kamesam expresses his appreciation and thanks to Dr. Richard Falck, formerly of the Mycological Institute, Hahn-Munden, for the facilities and help offered him at this laboratory where most of the experimental work was done. Because of the fact that the experimental work was carried on under Dr. Falck's direction, it is only natural that arsenicals would assume an important rôle as wood preservatives. Then too it must be borne in mind that in India, industrial and economic conditions are quite different from those obtaining in the United States. For this reason there may be more justification in India for attempting to substitute arsenicals for coal-tar creosote than in America where coal-tar creosote has been found to be a most generally satisfactory and economical wood preservative.

The laboratory technique employed by Kamesam to determine the toxicity of wood preservatives is essentially that employed by European investigators, especially in Germany, and usually designated as the "Wood Block Method." Air-dried wood blocks of known weight were impregnated with different concentrations of solutions of the antiseptic under test. The blocks after drying were exposed in suitable glass flasks to pure cultures of the test fungi; namely, *Coniphora cerebella Lenzites thermophila,* and *Fomes annosus.*

Kamesam also determined the toxicity of different chemicals to insects; namely, *Callandra,* a grain beetle, and *Dinoderus,* a beetle usually found in dry bamboo. To determine the toxicity of the chemicals to insects, the chemicals were distributed uniformly in hard wheat "noodles." These consisted of 25 grams of wheat flour and 1 cc. of white of egg mixed with 0.25 g., 0.125 g., 0.1025 g., 0.0125 g., and 0.00025 g. of the chemical under test. Enough water was added to make a thick paste which was rolled out into flat noodles about 8 m.m. wide and 3 m.m. thick. These were dried at 80°C. for about twenty-four hours. About 5 g. samples were placed in glass tubes. A known number of beetles were added to each tube. Every few days for a period of three to six weeks, the tubes were inspected and the number of dead beetles observed. A large amount of data showing the results of these tests are given in the bulletin.

The relative leachability of the water-soluble wood preservatives and their effect on mild steel was also determined.

On the basis of the results of all of these tests, Kamesam attempted to determine the relative value as wood preservatives of all the chemicals studied. It was assumed that the composite value indices of the different wood preservative chemicals may be taken as a function of the following factors:

1. Cost.
2. Leachability.
3. Toxicity to a typical wood destroying fungus.
4. Toxicity to insects.
5. Effect on mild steel at 20°C., or 80°C.

Different weightage numbers for these five factors were assumed and the composite index value for each of the chemicals calculated. "Falkamesam" (a proprietary preservative containing in addition to other chemicals, arsenic pentoxide and potassium dichromate) is given the highest rating.

Kamesam's bulletin is of greatest interest to American readers because of the results of the laboratory tests published therein. In the opinion of the reviewer, considering the present state of our limited knowledge of the factors which contribute to the success or failure of a wood pre-

servative in actual use, the general recommendations given in the bulletin seem somewhat premature. No substitute has yet been found for service tests of treated material, and it is extremely doubtful if such substitutes will ever be found. At least, until it is definitely known that a copper-arsenic treatment will be effective in the case of timber used in brackish or sea-water, it would seem wise to continue to recommend the use of adequate coal-tar creosote treatments for such timber.

HENRY SCHMITZ.

Die Wurzelforschung in ihrer Beziehung zur praktischen Forstwirtschaft. (German summary of Finnish bulletin). By Erkki Laitakari. *Acta Forestalia Fennica 33, pp. 1-31. 1929.*

This stimulating article deals with root investigations and their relationships to practical forest management in Finland. American foresters know little of the root systems of the forest crops they are growing and propose to grow.

The root systems of trees are less investigated than those of other plants. It is desirable to know forest tree root systems, their forms, their spread, and their development under different situations in order to understand the growing conditions of a single tree and of a whole stand.

The average depth of horizontal roots of pine become deeper with age at a fairly normal rate. This is partly due to the increasing weight of the tree and root system. When the vertical root system of older trees has reached its final extent, no great variation in the average depth of roots takes place. This also holds true for spruce although the investigated material is smaller. Competition between trees of different sizes is less severe than that of trees of the same size. Seedlings (e.g.) do not especially suffer during the first year from the competition of roots of the mother tree.

The author has previously reported on the root system of Scotch pine. Although relatively few measurements of spruce were made, the work confirmed the common opinion that the horizontal roots of young spruce are nearer the surface than that of young pine of the same size and also old pine on similar test areas. No observations were made of mature spruce nor on the dry sandy heaths. The root system of a single birch tree was investigated and appears to be as deep as pine if not deeper.

Mixtures of pine and spruce, and of spruce and birch show less root competition than when in pure stands. In selecting species for planting stock, those species whose root systems compete the least with one another should be carefully considered. Root competition between the vertical roots of different species is relatively insignificant in comparison with the horizontal roots. The roots of different tree species may even follow down the cavity of rotten roots together and still have sufficient room. Pine has a well developed vertical root system, whereas that of spruce is much poorer or lacking. It is well known that spruce thrives underneath pine.

Root competition between weeds, bushes, grasses and seedlings is severe in the upper layers of the soil. Accordingly it is important to know the extent of the root system of the ground cover in order to determine what species should be suppressed or destroyed.

It is a common opinion that the deep root system of pine scarcely suffers from light burning. It is true that a portion of the root system of pine is deep and this remains uninjured; however, the greater part of the roots extend horizontally,

close to the surface, sometimes only two to three centimeters under the surface. The author has found many pine roots dead and rotten in burned areas. One cannot therefore believe that pine suffers light injury. Where the root systems are severely injured the new roots are weak. There is an ensuing decrease in growth.

Light burning may, however, pay in obtaining good natural regeneration. The favorable influence of forest fire on reproduction may be due to the lessening of root competition with mother trees. On the other hand the roots of seedlings are severely injured by fire and by the use of soil cultivating implements so that the growth of trees may decrease and the viability of seeds from seed trees be accordingly diminished. The roots of spruce and pine run along close to the surface under moss or lichens. In quite young spruce the roots may be laid bare when the moss layer is removed. One must know the depth level of the root systems of the individual tree species under different conditions before using fire as a silvicultural tool.

The extent of the root system depends on the density of the stand. Illevssalo has shown that the better forest types are characterized by having a greater number of trees of similar size. The extent of root systems accordingly diminishes with increasing site quality on similar soil types. There is a relationship between the extent of the root system and soil type but not between soil type and density of natural stands.

The number of trees in spruce stands is greater than that in pine stands of the same diameter although the root systems appear to extend farther than that of pine. Hilf observed that the outer half of the spruce root system lies outside the crown range so that the essential portion of the roots is smaller than the total area of the root system.

Laitakari confirms the work of other European investigators in that the root cavities left by earlier trees are of great significance for the vertical roots of the present stand. These root cavities tend to become choked when the land has been used for agricultural purposes or left idle. It is difficult to reforest such areas. This is especially true not only for all the compact and imperfectly drained soils but also the sandy soils. In them the roots are quickly destroyed and the cavities closed. The low fertility of such soils often results in poor growth. It is essential to reforest areas destroyed by fire before the roots rot and the cavities become choked. In choosing species for reforestation great care must be taken; for even then the chances for failure are great.

The natural structure of the soil is destroyed by the removal of stumps. The author does not feel that this practice should be encouraged although it destroys nesting places of insects. Laitakari found deep vertical roots developing under the stumps. A deep root system must be of considerable importance in obtaining water on the dry heaths.

The trees best suited for the open areas are those that root deeply and profusely. The planting of pine on sandy soils is questionable, since the root system of pine is very shallow. In Finland birch is better suited for such places than are the conifers. While birch grows slowest on the drier Calluna heaths, the growth of pine is also scanty. Pine grows better than birch on the loose soils. In a previous study the author found that on the Calluna type the pine and birch had respectively diameters of 15.5 and 10.5 centimeters at breast height, but the average depths of horizontal roots were respectively 8.8 and 17.9 centimeters. The soils are morainic.

It has long been observed that the roots of spruce and fir actually unite. This occurs also in pine stands, but to a lesser degree. The wind resistance is un-

doubtedly increased when this occurs near the root collar. A part of the root systems of trees removed by thinnings may be used by the remaining trees. This phenomenon occurs most frequently in dense stands. The favorable influence of thinning is greatest in thicker stands.

A knowledge of the root systems of different species is essential from the standpoint of practical silviculture. It is desirable to know in thinning how far the roots of the removed trees extend. Such information is also desirable when working the soil next to the forest boundary and to seed trees in order to avoid injury. It is desirable to know in what soils the roots do not anchor themselves. The roots of trees tend to thicken against the prevailing wind especially when a heavy vertical root system is lacking. A knowledge of the proportion of vertical and horizontal roots, of root volume to stem volume, of the distance of the main portion of the roots from the root collar would be of considerable value.

An excellent bibliography accompanies the article and considerable space is given to a comparison of the results of other workers. It would seem that an article emphasizing the differences in the rooting habits of different forest tree species should be accompanied by a detailed description of the soils which are, however, very roughly described.

Charles Diebold,
Cornell University.

Meria laricis, The Leaf Cast Disease of Larch. By T. R. Peace and C. H. Holmes. *Oxford Forestry Memoirs No. 15, 28 pp. The Oxford University Press, London.*

Meria laricis Vuillemin, the leaf cast disease of the larch, was first described by Mer in 1895. The disease was first reported from France, but later also was reported from Germany, Austria, Italy, Norway and England. The disease does not appear to have been recorded from America.

In England, leaf cast appears to be the most important fungal disease of the European larch in the nursery. The fungus also attacks the western larch (*L. occidentalis*), but the Japanese (*L. Kaempferi*), Siberian (*L. siberica*), and Korean larch (*L. Gmelini*) are extremely resistant.

The disease causes a browning and shedding of the needles. It usually appears on new needles at the beginning of May. The disease is greatly influenced by moisture, dry weather, dry weather often causing an almost complete cessation of attack. The fungus overwinters on the needles of the previous year, lying on the ground or still attached to the plant. Apparently it is unable to spread very far without biotic aid and consequently new nurseries can be kept free from the disease by bringing larch into them only in the form of seed.

A considerable amount of work was also done on the possibility of controlling the disease by spraying. Spraying recommendations are given, which are to some extent provisional. The fact is emphasized that it is usually easier to prevent the disease from becoming established in nurseries than to control it after it has become established.

Several other fungi cause a disease of European larch somewhat resembling that caused by *Meria laricis.* These are *Cladosporium laricis, Sphaerella laricina,* and *Hypodermella laricis.* None of these fungi, however, appear to have been reported from England. The disease caused by *Meria laricis* may also be confused with frost damage to larch. The differences between the damage caused by frost and that caused by *Meria* are described. Frost has been described as a predisposing factor to the disease, but it has been

found that *Meria* can become epidemic without any aid from it.

The morphology and biology of *Meria* in culture were also studied, and the results of this study are reported in considerable detail.

Messrs. Peace and Holmes have made an important contribution to forest pathological literature. This study may well be taken as an example of how forest tree diseases should be studied. It is encouraging to note that in England mycological research is financed by the Forestry Commission. Can it be that our English forester cousins across the sea have a nicer appreciation of the importance of forest pathology to forestry than we in this country?

HENRY SCHMITZ,
University of Minnesota.

CORRESPONDENCE

On the Cause of Bird's-Eye Maple

Editor, Journal of Forestry,
Washington, D. C.
Dear Sir:

The pictures that we form from data may be likened to shadows, which are long or short, faintly or distinctly outlined, as the light varies; whence it happens often that a few data, which have been gathered in the uncertain light of an unknown environment, throw very realistic shadows under varying lights and thus constitute, as it were, a very plastic material in the hands of opinion. This may be illustrated sufficiently, perhaps, by the pictures that can be shadowed forth from the data that are presented in the article "Is Suppression A Possible Cause of Bird's-Eye in Sugar Maple?" by L. A. Holmberg, which was published in the Journal of Forestry for December, 1933 (Vol. XXXI, No. 8, Pp. 968-970). That article relates, as its title indicates, to a most perplexing phenomenon, which is of special interest to geneticists as well as to foresters. This discussion of the article cannot, nor does it seek to, overthrow the author's conclusion regarding the cause of the phenomenon; it merely shifts the light a little, and, of course, the shadows, which the data then cast, appear somewhat different in clearness, form, and size.

The author's conclusion is that suppression causes the figure; for, although the title of the article questions, its substance affirms and is positive. Thus, to quote "We may conclude from the above table that the great majority of trees which are severely suppressed during the first century of their growth will develop the bird's-eye figure to a commercial extent." The data, as he admits, do not prove his hypothesis. Another may believe that the figure is hereditary; the data do not disprove this hypothesis. Another, seeing the data in still another light, or wishing (it may be) to avoid the dangers of the Scylla of environment on the one hand and the Charybdis of heredity on the other, might conclude that there is a safer middle way over which neither heredity nor environment has exclusive authority; the data are attractive to this hypothesis likewise. The shadows, which the data cast in the light of these hypotheses, are different, but in no instance are they grotesque. Therefore, since the data have been presented in the light of but one of them and since the investigation of the phenomenon is hardly in its final stages, it may not be presumptuous or inopportune to interpose some of the theoretical claims of the other (genetical) side.

To avoid ambiguity, terms must be defined. Since the author uses the term "suppression" freely and without definition or reference thereto, it is, perhaps, legitimate to suppose that he does not regard suppression as being synonymous with slowness of growth. I interpret his use of the term to mean growth reduced below inherent tendencies by external conditions.

The data strongly suggest a correlation between slowness of growth and the bird's-eye figure. Suppression is assumed to be the cause of the observed slowness of growth. The question arises "Was it?" For such growth-rapidity differences might result as readily from hereditary, as from environmental, causes, whence the ob-

served difference does not necessarily identify the cause of the figure. The geneticist might deem it as logical to conclude that the phenomena are hereditarily correlated or linked, and his conclusion would be based on excellent premises, as any good text book on genetics will attest. In fact, he could adduce excellent theoretical reasons for reversing the author's conclusion and asserting that the observed slowness of growth is caused by a factor for the bird's-eye figure. Such linkages are not unusual; the chromosome theory of inheritance, which is generally accepted by geneticists, has some of its strongest support in the numerous linkage relationships that have been disclosed experimentally. They provide powerful genetical tools that enable the investigator to explore the heredity of the species more rapidly, and they are useful in other ways; therefore, the geneticist always expects and searches for them.

Since *both* heredity and environment may affect the rate of growth and nothing is known about the conditions under which each of the bird's-eye trees grew, nothing adequate to the purpose can be concluded regarding the cause of the rapidity or prolonged slowness of growth of the individual trees. Therefore, since the hypothesis (that suppression causes the slow growth and hence the figure) requires a great multitude of affirmative cases in support (unless a breeding-test is resorted to), and even then could be demolished by the power of a single, well established, negative instance, it is obvious that the data that were obtained from the examination of twenty-six trees mentioned by the author cannot alone give any great support to that hypothesis.

In view of the subtle and powerful influences that environmental factors are known to exert on the expression of hereditary characters, a study of differences in rapidity of growth, which establishes the fact alone and ignores the cause, can hardly produce facts sufficient for the scientific proof of the author's conclusion, notwithstanding the comfort that may be derived by the environmentalist from the apparent relationship that exists between the intensity or distinctness of the bird's-eye figure and the rate of growth. It is easily conceivable that the tendency or power to produce the bird's-eye figure *under certain environmental conditions* is inherited. Thus, suppression might intensify the expression of the figure without being its fundamental cause; so that, of a number of suppressed trees, some might have the figure and some might not. But if environment alone were responsible, any tree would produce the figure upon being suppressed, and in this respect all the trees would be hereditarily equal. Therefore, a study of the location of bird's-eye trees in the stand might be of great value in a search for the cause. Such a study might well seek to ascertain not only whether all suppressed trees have the figure or not, but also whether or not all vigorous and (or) dominant trees do not have it; for exceptions in either class would constitute annihilating evidence against the hypothesis.

F. I. RIGHTER,
Inst. of Forest Genetics.

IS HEREDITY A POSSIBLE CAUSE OF BIRD'S-EYE IN SUGAR MAPLE?

Editor, JOURNAL OF FORESTRY,
Washington, D. C.

Dear Sir:

The article entitled "Is Suppression a Possible Cause of Bird's-eye in Sugar Maple?" is only one, but nevertheless a particularly colorful ray of light upon a very interesting and apparently controversial subject. It is an outgrowth of a more complete investigation carried on at the Lake States Forest Experiment Station especially from the standpoint of heredity.

Had it been regarded as the final word in the matter, the article should have been entitled, "Suppression *is the* Cause of Bird's-eye in Sugar Maple." Previous to this study there was no factual basis for the highly advisable "middle course" advanced by Mr. Righter.

Among the chief conclusions (though hardly suitable for publication) were the need and procedure of further investigation. The chief value of the shorter research projects lies in the discovery of material for further study. No extended researches should be made without one or several preliminary investigations upon which to base further procedure.

As would be expected, the cambium of the figured trees transmits certain evidences of the figure to the bark, especially in the fissures, by which bird's-eye trees can be identified in the stand by the trained and careful observer. Thus it would be possible to obtain certain information concerning the environment of particular trees showing the figure.

Our data has revealed that an ecological study of the problem would have to extend over a period of as much as two centuries to give conclusive proof. The present surroundings of a particular tree might not reveal basic environmental causes, for the reason that the virgin stand is constantly changing. New trees are springing up, others are fading away, and shortly there remains no evidence on the ground of their ever having existed. Due to the fact that bird's-eye figure is not apparent until the tree is between fifty and ninety-five years old, even a study of the genetics of bird's-eye maple would necessarily extend over a period greater than the useful life-span of one investigator. We must therefore take advantage of all the material and virgin stands available at present without delay in order to lay out plans of procedure for future generations to follow if this most beautiful wood is to be produced by them.

We must not permit the "uncertain light of an unknown environment" to deter us. In the hands of the skillful modern investigators collections of evidence become true pictures and authentic biographies of the trees studied. Nor need we fear the "personal equation" which is portrayed as molding the "plastic material" of fact. Only the conclusions may change. Highly constructive rays of light come through the prisms of personal opinion. Given the basic honesty and fairness, without which no man is a capable investigator, conclusive facts are in safe hands.

In order to obtain a more intimate picture of the individual trees, they were separated into small groups to determine the growth trends. When these groups growth trends were applied to the individuals, it was found that with only one exception our conclusions as submitted were accurate. In this case the tree might equally well have been placed in the group having light figure or later losing it, as it was in the group next above it having no figure at all. Clearly this was a border line tree influenced by one or many variables.

The theory of linkage cannot be refuted, but it may be strongly suspected that the inherent weakness referred to is really inherent strength to withstand a century of such slow growth, without succumbing, as is present in only seven per cent of the decades for all trees and ages in a virgin stand. Undoubtedly such exceptional conditions of prolonged slowness of growth (otherwise spoken of as suppression) are found in the lives of a small fraction of one per cent of the trees in a virgin stand.

As has been suspected, the editorial command "Be brief and stick to your subject!" has caused the deletion of much information and data which would have had a bearing on the present discussion.

LeRoy H. Holmberg,
N. Y. State Conservation Dept.

Sectional Representation on the Council and Occupational Classification of Society Members

Pursuant to the petition of the Allegheny Section requesting the consideration of the matter of Sectional representation on the Council, and in connection with the proposed changes in membership policy which have been discussed before several Sections, the Constitution of the Society will be brought up for revision by vote of the members this coming fall.

Probably the most difficult problem in this connection will be to work out a plan for Sectional representation suitable to all the Sections and to the membership at large and still retain a Council of not more than 11 members. It seems to be generally conceded that to give each of the 17 Sections a representative on the Council would not only make the latter unwieldy but would give Sections unequal weight, due to disproportionate membership. Consequently any such plan requires a gerrymander of the Sections into districts or voting regions. A purely tentative plan was submitted to the Sections in March. As an aid in considering the relative merits of representation by voting districts on the one hand, or by general vote of the Society as at present, on the other, Table 1 is submitted which was prepared with the coöperation of the secretaries of the different Sections to whom acknowledgment is hereby made.

The table gives the Sectional estimates of active voting membership as of approximately March 1, divided into occupational classes. The item, "Other U. S. Depts.", includes the Indian Service, Park Service and divisions in the U. S. Department of Agriculture. The data on the C.C.C. employment is probably not completely separated from the Forest Service but may be accepted for the present. Under Education, farm forest extension is included as well as secretaries of trade associations. The percentages as well as the number in each class are given for each Section, and a summary showing total government, states, educational and private status. It may be noted that the largest Section outnumbers the smallest by a ratio of 7½ to 1 and that five Sections contain more than half of the membership. Government service includes 55 per cent, and with states' service, public employment accounts for 71 per cent of our membership. When educational positions are deducted, there remains but a little over one-tenth of the enrollment in private employment. In the report on forest education by Graves and Guise, Table 1, page 32, the percentages of employment of 1718 graduates, omitting foreign, and tree and landscape work, totalled, for all public employment, plus education and extension, 64.6 per cent as against present Society enrollment, omitting non-forestry and unknown, of 88 per cent. Private forestry, on the same basis, shown by Table 1 to be preponderantly in the forest industries, gave a percentage of 35.4, as against Society enrollment of 12 per cent. There has been a considerable shift from private employment to temporary jobs in forestry with the federal government, but if the 8 per cent given for the C.C.C. in Society data is considered as deducted from private industry, the figure on this corrected basis still remains 23 per cent as against the Society membership of 12 per cent.

TABLE 1[1]

OCCUPATION CLASSIFICATION OF VOTING MEMBERS OF THE SOCIETY, MARCH 1934

Section	U. S. Forest Service		Other U. S. depts.		Total permanent U. S.		Temporary C.C.C.		Total U. S.		States and counties		Education extension association		Private		Not in forestry		Occupation unknown		Total voting	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
New England	30	11	....	....	30	11	71	26	101	37	47	17	41	15	61	23	12	4	11	4	273	100
New York	....	....	3	1	3	1	14	8	17	9	37	21	59	33	26	15	7	4	33	18	179	100
Allegheny	16	7	2	1	18	8	50	22	68	30	97	43	21	9	27	12	6	3	6	3	225	100
Washington	49	45	41	38	90	83	....	....	90	83	....	....	7	6	2	2	2	2	8	7	109	100
Ohio Valley	20	17	....	....	20	17	....	....	20	17	50	42	35	29	5	4	10	8	....	....	120	100
Wisconsin	53	71	1	1	54	72	....	....	54	72	10	13	1	1	7	9	3	5	....	....	75	100
Minnesota	22	30	....	....	22	30	12	15	34	45	11	15	18	24	7	9	5	7	....	....	75	100
Appalachian	67	58	14	12	81	70	....	....	81	70	14	12	10	9	7	6	3	3	....	....	115	100
Southeastern	21	38	....	....	21	38	....	....	21	38	21	38	5	9	6	11	2	4	....	....	55	100
Gulf	36	52	....	....	36	52	11	15	47	67	9	12	5	7	10	14	....	....	....	....	71	100
Ozark	17	46	....	....	17	46	7	19	24	65	6	16	1	3	5	13	1	3	....	....	37	100
Northern Rocky Mt.	79	65	25	20	104	85	....	....	104	85	1	1	9	7	6	5	2	2	....	....	122	100
Intermountain	56	87	....	....	56	87	....	....	56	87	....	....	4	6	1	2	2	3	1	2	64	100
Central Rocky Mt.	83	82	4	4	87	86	3	3	90	89	1	1	5	5	1	1	2	2	....	....	99	100
Southwestern	28	59	11	23	39	82	4	9	43	91	....	....	....	....	1	2	3	7	....	....	47	100
North Pacific	117	62	22	12	139	74	....	....	139	74	4	2	13	7	29	15	....	....	4	2	189	100
California	139	63	19	9	158	72	....	....	158	72	25	12	12	6	19	9	7	3	....	....	221	100
Total	833	40	142	7	975	47	172	8	1,147	55	333	16	246	12	220	11	67	3	63	3	2,076	100

[1]This table was prepared from estimates submitted by the Section Secr etaries, to whom thanks is due for their assistance. This classification, it should be noted, is only approximate. It is planned to do the job over again later in the year, more systematically and accurately.

There are two reasons for this condition. First, the Society was founded at a time when there was practically no employment outside of government service, and has thus drawn largely of this class until recently. The enrollment also includes a considerable number of federal and a few state employees who are not graduate foresters, while those of like status working for the forest industries have seldom been accepted. The second reason is that foresters although graduates, who are employed by lumber companies, sales agencies or other commercial enterprises have not taken as much interest in the Society, nor has the Council been as ready to admit them, until within the last year, when the principle was finally established that a degree in forestry qualified a candidate for admission to Junior membership without the necessity of being engaged in "forestry" work at the time of admission. Under past existing conditions, it would appear that the membership is representative of the different occupations, except in the field of forest industries, where it is notably deficient.

It is up to the Society to demonstrate its value to all classes of graduates in forestry and it is especially necessary at this time in view of the responsibilities facing the forest industries under Article X of the Lumber Code, that men entitled to membership by reason of graduation from forest schools should join the Society and identify themselves definitely with the profession of forestry which the Society represents. It is urged that both the Sections of the Society and especially the forest schools make an effort to arouse the interest of these private foresters and secure their application for membership during the present year. The Executive Secretary's office will extend any aid possible to accomplish this end.

H. H. Chapman,
President.

Doings of the Executive Secretary

On Marsh 12, attended the hearing before the NRA on President Roosevelt's proposed amendment to Article II of the Lumber Code.

On March 19, attended the hearing before the House Committee on Wildlife Conservation, on the bill to create the Everglades National Park in Florida. Since neither the Council, nor the Society as a whole, has ever taken a position on national park policy, I naturally could not testify concerning this proposed legislation.

Spent March 26 to 28 at State College and Mont Alto, Pennsylvania, first, to attend the annual banquet of the students' Forestry Club and address them regarding membership in the Society, and second, to renew acquaintance with the members of the Forest School faculty. It would redound to the good of the order if similar visits could be made each year to all the forest schools. Unfortunately the limitations of time and money stand in the way.

On April 5, 6 and 9, attended meetings of the Forest Conservation Code Joint Committee and of its sub-committee on legislation, to devise ways and means for the consummation of the public part of the Forest Conservation program.

Among the Society members who visited the Society office during the month were Paul G. Redington; Nelson Brown, New York State College of Forestry; Winslow L. Gooch, Chesapeake Corporation, West Point, Virginia; F. W. Besley, State Forester of Maryland and member of the Council; Tom Gill, Pack Forestry Trust; John F. Preston, Hammermill Paper Company, Erie, Pennsylvania; Henry M. Meloney, NRA; R. L. Hogue, Benton Harbor, Michigan. Other callers were R. Y. Yard, Secretary, National Parks Association; Harold M. Day, Convention Bureau Manager of the Syracuse, New York, Chamber of Commerce and a graduate of the New York State College of Forestry; and Mr. Andrews of the British Columbia Forest Service.

Franklin Reed, *Executive Secretary.*

Annual Meeting to Be Held in Washington

The 34th annual meeting of the Society will be held at Washington, D. C., January 28, 29, 30, 1935.

The committee on arrangements and program are: Franklin Reed, Chris Granger and H. H. Chapman.

All members of the Society who have suggestions regarding the program or arrangements for this meeting or have topics or papers in mind which they would like to present or hear discussed will please communicate promptly with any member of the committee. Full consideration will be given to all communications in an effort to select the subjects and papers offering the greatest interest and benefit to those attending.

Society affairs will be given a prominent place on the program.

Francis Garner Miller

1866-1934

The death of Francis G. Miller, Dean of the School of Forestry, University of Idaho, occurred on March 8th, from heart disease. Miller's health had been gradually failing, but with the devotion to duty which had marked his entire professional career, he carried his responsibilities until within a few days of his death.

His loss means the passing of one of the pioneers and outstanding men of the profession. In his chosen field of teaching he had a long and honorable record. For two years after his graduation from the Yale School of Forestry in 1903 he was associated with the U. S. Forest Service with George Clothier and others in developing planting in the plains section, during which period he was on the teaching staff of the forestry school at the University of Nebraska.

In 1907 Miller organized the forestry department at the University of Washington at Seattle and was dean of that School until 1912. After a three year interim, as manager of the Wenatchee Columbia Co. in commercial orcharding, he became head of the forestry department of the State College of Washington at Pullman.

In 1917 Miller was chosen as dean of the School of Forestry at the University of Idaho, serving in this capacity until his death, building up a strong and efficient school. He was fully alive to the broader responsibilities of his profession and served as a most useful and effective member of the Idaho State Coöperation Board of Forestry since its inception. His influence was constantly felt in the laws and administration of the regulatory fire control measures supervised by this board.

In 1932 Dean Miller and his wife took a sabbatical year in Europe. During the

Francis Garner Miller

last year his principle responsibility was the organization of the new school forest. It is said that in 43 years Miller never missed an appointment on account of illness.

To all who knew him Dean Miller was uniformly courteous. He had an infinite capacity for painstaking labor and mastery of detail, combined with clear vision and sound judgment of relative importance of things. He commanded universal respect, from his students, from the lumbermen of Idaho, from legislators, the public and from his host of friends in forestry. His passing is a great loss but the tradition of unselfish service which he exemplified has been welded into the institution whose course he guided for seventeen years.

Francis G. Miller was born at Lanark, Illinois on June 2, 1866, son of Isaiah and Isabel Jane Miller. He is survived by his wife Evelyn Depew Miller and by one brother and seven sisters.

H. H. Chapman.

PERSONALS

Paul G. Redington has returned to the U. S. Forest Service. In a press statement issued on February 26, Secretary of Agriculture Wallace announced that Mr. Redington, who has been Chief of the Biological Survey for the past seven years, would return to the Forest Service in an important administrative position on March 1; that his transfer was brought about at his own request; and that it will make his previous long experience again available to that service, where certain important activities are now expanding.

Mr. John Barnes of Berkeley, California, has been appointed to handle forestry and game management work for the Soil Erosion Service in the Tennessee Valley on stations to be established in northern Alabama, Tennessee and western North Carolina.

SECTION NEWS

Minnesota

An open meeting was held on March 1st at 6:30 P. M. in the Men's Union, University of Minnesota. Thirty-two were present, of whom seventeen were members. After dinner, William T. Cox presented a very interesting illustrated talk on forestry in Brazil.

At the meeting of April 12, Mr. Frank Yetka, Secretary of the Minnesota Conservation Commission, and Mr. E. W. Tinker, Regional Forester, discussed "The Problem of Public Forests in Minnesota."

A field meeting was held on April 14-15 at LaCrosse, Wisconsin. The afternoon of the 14th was spent looking over the erosion control work as carried on in the vicinity of Winona by Mr. Carlos Bates, of the Lake States Forest Experimentation Station. The following speakers and subjects were presented at the evening session: R. H. Davis, Regional Director, Soil Erosion Service, LaCrosse, Wis., "Erosion Control in the Coon Creek Watershed"; E. H. Hardisty, Bureau of Agricultural Engineering, "Experimental Projects at the Upper Mississippi Erosion Station"; L. C. Tschudy, Bureau of Agricultural Engineering, "C. C. C. Activities in the Erosion and Flood Control Camps of Wisconsin, Minnesota and North Dakota"; O. E. Hays, Supt. Upper Mississippi Valley Erosion Experiment Station, "The Experimental Program of the Bureau of Chemistry and Soils, and Its Bearing on the Erosion

Control"; R. C. Steele, Supt. Upper Mississippi Game and Fish Refuge, Winona, Minnesota, "The Effect of Erosion Control on the Upper Mississippi Game and Fish Refuge"; E. G. Holt, Conservation Biologist, "Integration of Forestry and Game Management in Erosion Control." A field trip was made on April 15 to the erosion station and the Coon Creek watershed.

Elections to Membership

The following men have been elected to the grade of membership indicated:

ALLEGHENY SECTION

Junior Membership

Ackerman, Philmore E.
Chisman, Henry H.
Clouser, Rex Walter
Cooper, William Edward
Dunpal, William McKee
Fetzer, Carl D.
Foreman, Harry A.
Fritz, Nelson Herbert
Holtz, I. Basil
Kern, Samuel J.
Kinney, Chester L.
Leader, J. Norman
Muth, Frank Theodore
Nadler, Harry
Olliver, Ephe M.
Renshaw, James F.
Savage, Wilbur L.
Sluzalis, Laurence L.
Sowers, Jr., David W.
Ward, William B.
Werner, Edward H.

Senior Membership

Baumann, Herman
Farley, James P.
Gerhardy, Carl O.
Oliver, Thomas K.
Pemberton, Jr., James E.
Smith, Leland S.

CALIFORNIA SECTION

Junior Membership

Berriman, Leland F.
Boehm, Edward E.
Bower, Russell W.
Buck, John M.
Burks, George F.
Dennison, Sidney V.
Durbrow, Houghton
Fischer, William Frederick
French, Norman Hughes
Gifford, Arthur D.
Hughes, John E.
Kernohan, Clifford T.
Klugh, Richard H.
London, Arthur
McLees, Kenneth C.
Meckel, Fred A.
Mors, Richard Henry
Nordstrom, George T.
Nourse, Everett F.
Perkins, Neil L.
Short, Laurence R.
Sowder, James E.
Spinney, Wesley W.
Stowell, Morton Deene
Swensen, Marriner
Vance, Gordon B.
Wagner, Claude A.
Wagner, Roy G.
Watson, Alice D.

CENTRAL ROCKY MOUNTAIN SECTION

Junior Membership

Anderson, Clarke A.
Anderson, Lionel C.
Barrows, Maynard
Brown, George K.
Harp, Gordon D.
Kreutzer, Edward M.
Laird, Leonard H.
McCord, Paul P.
McCutchen, A. A.
Price, LaMar G.
Walker, Nat
Worthington, Elmer L.

MINNESOTA SECTION

Junior Membership

Campbell, Donald W.
Christopherson, Ralph Hane
Dahl, Ernest B.
Dolence, Frank L.
Jally, William W.
Kukachka, Emil G.
Miley, Harry G.
Price, Donald E.

Senior Membership

Probstfield, Edwin Elroy

NEW ENGLAND SECTION

Junior Membership

Airoldi, Louis
Bunnell, Ralph G.
Croke, W. Harry
MacNaughton, Victor B.
Orsi, Charles Robert

NEW YORK SECTION

Junior Membership

Batterson, Leigh J.
Bergoffen, William Wolf
Brentlinger, Paul D.
Chaikin, Leon Edward
Fohrman, Fred E.
Holmberg, LeRoy A.
Hahn, Palmer Leonard
Hamilton, James F.
Robens, Ward Harold
Stark, Eric W.
Wangaard, Frederick F.
Wiese, Fred W.

NORTH PACIFIC SECTION

Junior Membership

Blomstrom, Roy
Hartman, Homer J.

NORTHERN ROCKY MOUNTAIN SECTION

Junior Membership

Clarke, Stanley C.
Davis, William L.
Ficke, Herman O.
Fisher, George M.
Flint, Alfred A.
Frykman, Joel L.
Jahn, E. C.
Marks, Elmer R.
Neff, Laurence P.
Pierson, Royale K.

OHIO VALLEY SECTION

Junior Membership

Fuerchtenicht-Boening, Rudolph

OZARK SECTION

Junior Membership

Benson, Carl Eynar
Gray, Walter J.
Hawes, Edmund Thacher
Settel, Lee S.

SOUTHEASTERN SECTION

Junior Membership

Pilmer, Harold E.

SOUTHWESTERN SECTION

Junior Membership

Diggs, Robert Lewis
Keeney, Kenneth Andrews

WASHINGTON SECTION

Senior Membership

Bedwell, Jesse L.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Junior Members, Senior Members and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the April Journal, without question as to eligibility. The names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before June 10, 1934. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBERSHIP

Name and Education	*Title and Address*	*Proposed by Section*
Barrett, Laurence Univ. of Wash., B.S.F., 1932.	Technician (Junior Forester), T.S.I., Lurton, Ark.	Ozark
Beeman, Robert M. Univ. of Wash., B.S.F., 1932; Yale, M. F., 1933.	Cultural Foreman, U. S. F. S., Camp F-4, Moulton, Ala.	Southeastern
Bignell, George A. Mich. State, 1905-1909.	Foreman, Timber Stand Imp., Tripp Canyon Camp, Pima, Ariz.	Southwestern
Bishop, Alfred H. N. Y. State, B.S.F., 1929, M.F., 1931.	Forester, C. C. Camp, Ricker Mills, Vt.	New York
Blakeney, J. C. N. C. State, B.S.F., 1933.	Project Supt., Buck Creek Camp F-4, Marion, N. C.	Appalachian
Boe, J. H. Two year course, West of Scotland Agric. College, 1916; Practical course Univ. of Wash., 1917.	Forestry Foreman, Camp McNairy, Selmer, Tenn.	Appalachian
Bromley, W. S. Pa. State, B.S.F., 1931.	Camp Supt., C.C.C. Camp Zaleski, S-56, Zaleski, Ohio.	Ohio Valley
Brown, Gordon L. Mich. State, B.S.F., 1932.	Forestry Foreman, Camp Este F-3, Nemo, So. Dak.	Central Rocky Mt.
Burnside, J. Oliver Colo. Agric., B.S.F., 1932.	Asst. Cultural Supt., Ozark N. F., Russellville, Ark.	Ozark
Campbell, Bernard T. N. Y. State, B.S.F., 1932.	Cultural Foreman, U. S. F. S., Spike Camp, Pleasant View, Va.	New York
Campbell, Robert A. Mich. State, B.S.F., 1932.	Technical Foreman, E.C.W., U. S. F. S., Strongs, Mich.	Minnesota
Carr, Edward T. Mich. State, B.S., 1933.	Technical Foreman, U.S.F.S., Camp 16-A, Globe, Ariz.	Southwestern
Centerwall, Bruce Univ. of Mont., B.S.F., 1932.	Technical Foreman, U.S.F.S., Winnibigashish Dam Camp, Deer River, Minn.	Minnesota
Coonrod, Melvin A. Univ. of Idaho, B.S.F., 1932.	Cultural Foreman, C.C.C. Camp TVA-4, U.S.F.S., Boise, Idaho.	Northern Rocky Mt.
Cox, Allen H. Univ. of Wash. B.S.F., 1930, M.S. F., 1932.	Cultural Foreman, T.S.I., Ozark N. F., Russellville, Ark.	Ozark
Curtis, Valleau C. N. Y. State, B.S.F., 1926.	Forester and Nurseryman, Charles Curtis Company, Callicoon, N. Y.	New York
Davis, Paul B. Geneva College, A.B., 1927; Pa. State, B.S.F., 1930.	Chief Forester, Asst. Supt., Morgan-Monroe State Forest, Martinsville, Ind.	Ohio Valley
DeVries, Wade E. Univ. of Mich. A.B., 1921; Univ. of Calif., M.A., 1922.	Taxation Economist, Forest Taxation Inquiry, U.S.F.S., Wash., D. C.	Washington
Ebert, Arthur J. Colo. Agric., B.S.F., 1926.	Sr. Forest Ranger, U.S.F.S., Collbran, Colo.	Central Rocky Mt.
Elder, Lynn Univ. of Wash., B.S.F., 1931.	Timber Stand Imp. Foreman, Camp Sylamore, Calico Rock, Ark.	Ozark
Ernest, Albert D. Ala. Poly. Inst., 1922-1923.	Associate Timber Expert, Forest Survey, Box 92, Lake City, Fla.	Southeastern
Field, W. D. Univ. of Idaho, B.S.F., 1926.	Assistant to Land Agent, Potlach Forests, Inc., Lewiston, Idaho.	Northern Rocky Mt.
Fleishel, J. Percy N. Y. State, B.S.F., 1925.	Purchasing Agent, Putnam Lumber Company, Shamrock, Fla.	Southeastern

Name and Education	*Title and Address*	*Proposed by Section*
Fonnesbeck, Frank O. Utah State, B.S.F., 1933.	Asst. Supt., T.V.A. Camp 25, New Tazewell, Tenn.	Appalachian
Forder, Milton H. Univ. of Minn., B.S.F., 1930.	Technical Foreman, Winnibigoshish Dam Camp, Deer River, Minn.	Minnesota
Franklin, Russell D. Univ. of Ga., B.S.F., 1931.	Camp Supt., C.C.C. Camp P-67, Bainbridge, Ga.	Southeastern
Gates, Earl Frank N. Y. State, B.S.F., 1928.	Forestry Foreman, C.C.C. Camp 63, Tuckahoe, N. J.	Allegheny
Gerred, Don L. Mich. State, B.S.F., 1933.	Technician (Junior Forester) N.I.R. A. Camp, Sante Fe N. F., Santa Fe., N. Mex.	Southwestern
Gilmore, Dudley W. N. Y. State, B.S.F., 1930.	Teacher of Biology, N. Tonawanda High School, Tonawanda, N. Y.	New York
Gray, Donald V. Mich. State, B.S.F., 1932.	Technical Foreman, C.C.C. Camp F-1, Glennie, Michigan.	Ohio Valley
Grogan, Harold L. Univ. of Ga., B.S.F., 1934.	Nursery Foreman, Clinton Nursery, T.V.A., Clinton, Tenn.	Southeastern
Gross, Virgil T. Univ. of Maine, B.S.F., 1932.	Cultural Foreman, C.C.C. Camp, Ft. Douglas, Russellville, Ark.	Ozark
Harris, Ernest A. Univ. of Wash., B.S.F., 1931.	Cultural Foreman, Ozark N. F., Russellville, Ark.	Ozark
Hebert, Clyde Harold La. State, B.S.F., 1934.	Welsh, La.	Gulf States
Hershberger, Ralph H. Pa. State, B.S.F., 1929.	Camp Supt., C.C.C. Camp S-54, Townshend, Md.	Allegheny
Holgate, Charles G. Univ. of Wash., B.S.F., 1931.	Cultural Foreman, C.C.C. Camp F-23, Lost Corner, Ark.	Ozark
Holsoe, Torkel Copenhagen, 1st degree, 1924, M. F., 1930.	Supt., Silvicultural Work, Morgan-Monroe State Forest, Martinsville, Ind.	Ohio Valley
Holt, Ted M. Univ. of Minn., B.S.F., 1934.	Forestry Foreman, Camp S-51, Kentucky.	Minnesota
Howland, C. F. Mich. State, B.S.F., 1927.	Camp Supt., Gibson Camp PE-56, Dyer, Tenn.	Ozark
James, Corland Lehman Univ. of Idaho, B.S.F., 1933.	Cultural Forester, C.C.C. Camp S-260, Troy Idaho.	Northern Rocky Mt.
Jones, Richard D. Univ. of Mich., B.S.F., 1934.	Technical Forestry Foreman, C.C.C. Camp Zaleski, Zaleski, Ohio.	Ohio Valley
Kilgore, W. Elbert La. State, B.S.F., 1934.	Dora, Alabama	Gulf States
Kroeber, John K. Mich. State, B.S.F., 1928.	Agent, Blister Rust Control, B.P.I., U.S.D.A., Escanaba, Mich.	Ohio Valley
Lansdon, William H. Univ. of Idaho, B.S.F., 1927.	Cultural Foreman, Camp Alabama, T.V.A. 5, Nitrate Plant, Ala.	Northern Rocky Mt.
Lehman, John William La. State, B.S.F., 1934.	1230 Bristol Highway, Kingsport, Tenn.	Gulf States
Lopez, Juan Univ. of the Philippines, B.S.F., 1925.	Dist. Forester, Forest District 9, Iloilo, P. I.	Arthur F. Fisher Franklin Reed O. W. Pflueger
Lorenz, Ralph William Univ. of Minn., B.S.F., 1930.	Technical Foreman and Blister Rust Control, Superior N. F., Duluth, Minn.	Minnesota
Lunnum, Knut Univ. of Wash., B.S.F., 1929.	Cultural Foreman, Camp F-16, Thornburg, Ark.	Ozark
Mark, Gordon G. Pa. State, B.S.F., 1932.	Junior Technician, N.I.R.A. Camp, Williams River, W. Va.	Allegheny
Marvin, Glenn E. Mich. State, B.S.F., 1927.	Supt., Michigan E.C.W., Wolverine, Mich.	Ohio Valley
Mathey, Norris Univ. of Wash., B.S.F., 1930.	Cultural Foreman, E.C.W., Camp Push Mountain, Calico Rock, Ark.	North Pacific
Meekins, E. H. N. Y. State, B. S. F., 1932	Cultural Foreman, E.C.W., U.S.F.S., Harrisonburg, Va.	Allegheny
Millard, Ned D. Iowa State, B.S., 1930.	Junior Forester, U.S.F.S., Ogden, Utah.	Intermountain
Mollenhauer, William, Jr. Mich. State, B.S.F., 1933.	Cultural Foreman, Ouachita N.F., Eagleton, Ark.	Ohio Valley

Name and Education	*Title and Address*	*Proposed by Section*
Monroe, A. F. Mich. State, B.S.F., 1922.	Supt., Carroll Camp PE-59, McKenzie, Tenn.	Ozark
Moore, Robert B. Pa. State, B.S.F., 1933.	Crew Foreman, E.C.W. Camp 56, Ways Landing, N. J.	Allegheny
Mosely, Geo. W. Univ. of Ga., B.S.F., 1933.	Forester, E.C.W., Ga. Forest Service, Waycross, Ga.	Southeastern
Muzzall, Alex H. Univ. of Calif., B.S., 1915, M.S.F., 1916.	Mgr., Goodyear Rubber Plantations, Kakasalon, Mindanao, P. I.	O. W. Pfluger H. Norton Cope Arthur F. Fischer
Nelson, Ralph William Univ. of Minn., B.S.F., 1934.	Landscape Foreman, Jay Cooke Park, Minnesota.	Minnesota
Newcomer, Fred R. Univ. of Idaho. B.S.F., 1931.	Technical Foreman, E.C.W. Camp 793, Hill City, S. Dak.	Central Rocky Mt.
Nicewander, Walter Purdue, B.S.F., 1933.	Junior Forester, U.S.F.S., Camp Chippewa River, Loretta, Wis.	Ohio Valley
Nordwall, David S. Mich. State, B.S., 1933.	Technical Foreman, E.C.W., Harney N. F., S. Dak.	Northern Rocky Mt.
Olden, James S. N. Y. State, B.S.F., 1929.	Cultural Foreman, Ozark N. F., Ark.	Ozark
Olson, Stanley B. Univ. of Minn., B.S.F., 1932.	Camp Foreman, N.I.R.A., Dinner Creek Camp, Deer River, Minn.	Minnesota
Percival, W. Clement N. Y. State, B.S.F., 1923, M.S., 1926, Ph.D., 1933.	Technician Junior Forester, Durbin, W. Va.	Allegheny
Petersen, Elmer Colo. Agric., B.S.F., 1929.	Cultural Foreman, Ozark N. F., Russelville, Ark.	Ozark
Petty, Clarence A. N. Y. State, B.S.F, 1930	Foreman, C.C.C. Camp 15, Tupper Lake, N. Y.	New York
Richards, Horace, Jr. Univ. of Idaho, B.S.F., 1933.	Green Lumber Foreman, Brooks-Scanlon Lumber Company, Bend, Oregon.	Northern Rocky Mt.
Ripatte, Carl H. Mich. State, B.S.F., 1923.	Camp Supt., E.C.W., F-15, Tigerville, Hill City, S. D.	Central Rocky Mt.
Roe, Arthur L. Univ. of Minn., B.S.F., 1932.	Cultural work, E.C.W., Superior N. F., Minn.	Minnesota
Ruff, Frederick J. N. Y. State, B.S.F., 1929.	Technical Foreman, E.C.W., Olustee, Fla.	Southeastern
San Buenaventura, Porfirio Univ. of the Philippines, B.S.F., 1932.	Asst. Forester and Dist. Forester, Bureau of Forestry, Zamboanga, Zamboanga, P. I.	Arthur F. Fischer Franklin Reed O. W. Pflueger
Sanders, Roy Dale Univ. of Minn. B.S.F., 1932.	Blister Rust Control Agent, B.P.I., Brainerd, Minnesota.	Minnesota
Schaap, L. P. N. Y. State Ranger School, 1927.	Dist. Forest Ranger, Pinchot Dist. Choctawhatchee N. F., Crestview, Fla.	Southeastern
Schumaker, Oren F., Univ. of Idaho, B.S.F., 1931.	Technician (Junior Forester) U.S. F.S., Brookhaven, Miss.	Northern Rocky Mt.
Sears, Esmond W. N. Y. State, Expects to return to college in May for B.S.	Woods Imp. Foreman, C.C.C. Camp Scioto, S-69, Friendship, Ohio.	Ohio Valley
Seastrom, Paul N. Univ. of Minn., B.S., 1934.	Field Asst. Lake States For. Exp. Sta., St. Paul, Minn.	Minnesota
Seguerra, Justino Univ. of the Philippines, B.S.F., 1933.	Ranger, Bureau of Forestry and Assistant, School of Forestry, Univ. of the Philippines, Laguina, P. I.	Arthur F. Fischer Franklin Reed O. W. Pflueger
Seizert, B. F. Mich. State, B.S.F., 1928.	Technical Foreman, E.C.W. Camp, State Forest, Henryville, Ind.	Ohio Valley
Sentell, Nathaniel Wesley La. State, B.S.F., 1934.	Plain Dealing, La.	Ozark
Setser, Alexander L. N. C. State, B.S.F., 1933.	Ranger Forester, T.V.A., Knoxville, Tenn.	Appalachian
Seymour, Wellington G. Cornell, 1923-1926; Univ. of Idaho, 1927-1929.	Forester, E.C.W. Camp 123, Elizabethville, Pa.	Northern Rocky Mt.
Shaw, Ezra I. Mich. State, B.S., 1912.	Technical Forester, C.C.C., October Mountain Forest, Becket, Mass.	New England

Name and Education	*Title and Address*	*Proposed by Section*
Shields, John F. Univ. of Mont., B.S.F., 1932; 15 credits toward M.S.F.	Sr. Topographic Draughtsman, U.S. F.S., Missoula, Mont.	Northern Rocky Mt.
Slater, Bradley F. N. Y. State, B.S.	Cultural Foreman, C.C.C. Camp F21, Plainview, Ark.	Ozark
Soriano, Doroteo Univ. of Philippines, B.S.F., 1931.	Forester and Asst. Prof. of Forest Surveying, U.S.F.S., P. I.	Arthur F. Fischer Franklin Reed O. W. Pflueger
Spiers, James F. Univ. of Ga., B.S.F., 1931.	Asst. Technician, Forest Survey, U.S. F.S., Lake City, Fla	Southeastern
Stauffer, Donald E. Mich. State, B.S.F., 1930; 17 credits toward M.F.	Forester, Platt Natl. Park, Sulphur, Okla.	Ozark
Stewart, Guy R. Univ. of Calif., B.S., 1906; Cornell, Ph.D.	Sr. Forest Ecologist, U.S.F.S., New Haven, Conn.	New England
Stratton, Harold M. Univ. of Wash., B.S.F., 1928	Junior Forester, U.S.F.S., Ouachita N.F., Mena, Ark.	Ozark
Stringfield, Will La. State, B.S.F., 1931.	Cultural Foreman, Nantahala N. F., Rainbow Springs, N. C.	Appalachian
Stover, William S. Mich. State, B.S.F., 1925.	Forest Survey, Southern For. Exp. Sta., Lake City, Fla.	Southeastern
Swanson, David C. T. Pa. State.	Asst. Supt., E.C.W. Camp 56S, Medaryville, Ind.	Ohio Valley
Swarthout, Arthur P. Mich. State, B.S.F., 1934.	Cultural Foreman, Pisgah N. F., Asheville, N. C.	Ohio Valley
Sypulski, John L. N. Y. State Ranger, 1929; 2 yrs. N. Y. State, 1933.	Field Asst. N. Y. State Ranger School, Wanakena, N. Y.	New York
Tremarello, Joseph N. Y. State, B. S., 1929.	1st Lt. Camp 20, T.V.A., New Tazewell, Tenn.	Appalachian
Vincent, Paul Y. Mich. State, B.S.F., 1932.	Technical Foreman, U.S.F.S., Flagstaff, Ariz.	Southwestern
Von Voigtlander, Karl A. Mich. State, B.S.F., 1931.	Technical Foreman, E.C.W. Ottawa N. F., Jackson, Mich.	Ohio Valley
Waldenberger, Emile R. N. Y. State, B.S.F., 1913.	Salesman for landscape work, Ivy Floral and Landscape Co., New York, N. Y.	New York
Warner, Edwin R. Univ. of Mich., B.S.F., 1933.	Cultural Foreman, Geo. Wash. N. F., Mt. Solon, Va.	Ohio Valley
Whitaker, Richard E. Univ. of Mont., B.S.F.	Asst. to Technician, U.S.F.S., Missoula, Mont.	Northern Rocky Mt.
Wild, Paul D. Mich. State, B.S., 1931.	Supt., Camp No. 3, Hiawatha N. F., Steuben, Mich.	Ohio Valley
Williams, Luther, Jr. N. C. State, B.S.F., 1932.	Cultural Foreman, Pisgah N. F., Hot Springs, N. C.	Appalachian
Yost, Paul A. Pa. State, B.S.F., 1929.	Supt., Camps 56S and 67S, Medaryville, Ind.	Ohio Valley
Ziegler, Karl F. Univ. of Minn., B.S.F., 1934.	Awaiting appointment with U.S.F.S., 2314 Quincy St. N. E., Mpls., Minn.	Minnesota

FOR ELECTION TO GRADE OF SENIOR MEMBERSHIP

Abbott, A.H. Univ. of Mont., Ranger short course (Junior Member 1921).	Forest Supervisor, Helena and Cabinet N.F., Thompson Falls, Montana	Northern Rocky Mt.
Arnold, Leroy D. Univ. of Mich., B.S.F., 1917. (Junior Member, 1929).	Asst. to Dir. of Forestry, Office of Indian Affairs, Wash., D. C.	Washington
Ashman, Robert I. Cornell, A.B., 1913; Yale, M. F., 1929. (Junior Member, 1930).	Asst. Prof. of Forestry, Univ. of Maine, Orono, Maine.	New England
Beattie, R. Kent Univ. of Neb., B.S., 1896, A.M., 1898. (Junior Member, 1932).	Principal Pathologist, Div. Forest Pathology, B.P.I., Wash., D. C.	Washington

Name and Education	*Title and Address*	*Proposed by Section*
Bradder, Wilbur E. N.Y. State Ranger School, 1918. (Junior Member, 1925).	Dist. Forester, Vt. Forest Serv. Rutland, Vt.	New England
Brockway, Earle M. Univ. of Maine, B.S.F., 1915. (Junior Member, 1924).	Blister Rust Control Agent, U.S.D.A., N. Abington, Mass.	New England
Dayton, W. A. Williams College, B.S., 1905, M.A., 1908. (Junior Member, 1926).	In Charge, Office of Forest Range Investigations, U.S.F.S., Wash., D.C.	Washington
Fields, Ralph E. Univ. of Mont., B.S.F., 1925. (Junior Member, 1926).	Asst. Supervisor, Custer N. F., Billings, Mont.	Northern Rocky Mt.
Fitting, R. R. Univ. of Mont., 3 terms, Ranger's short course. (Junior Member, 1929).	Forest Supervisor, Cabinet and St. Joe N. F., St. Maries, Idaho.	Northern Rocky Mt.
Gerrard, Paul H. Univ. of Idaho, B.S.F., 1923. (Junior Member, 1926).	Asst. Supervisor in charge of Blister Rust Control, Clearwater N. F., Orofino, Idaho.	Northern Rocky Mt.
Gilmour, John D. Ont. Agric., B.S.A., 1908; Forest School, Toronto, B.S.F., 1911. (Junior Member, 1929).	Consulting Forest Engineer, Northcliffe-Rothermere Interests, 75 Park Avenue, Quebec, Canada.	New England
Graeber, R. W. N. C. State, B.S. Agr. 1911, B.S.F., 1930. (Junior Member, 1927).	Ext. Forester, N. C. Agric. Ext. Ser., Raleigh, N. C.	Appalachian
Gravatt, G. F. Va. Polytechnic Inst., B.S., 1911, M.S., 1912; 2 years grad. work at Univ. of Calif., and Geo. Wash. (Junior Member, 1924).	Asst. Chief, Div. of Forest Pathology, B.P.I., Wash., D. C.	Washington
Gurley, H. H. N. Y. State, 3½ years. (Junior Member 1927)	Technical Assistant, Coeur d'Alene N.F., Coeur d'Alene, Idaho	Northern Rocky Mt.
Hartley, Carl Graduate, Univ. of Neb., W. Va., Geo. Wash., Hopkins; Univ. of Calif., Ph.D. (Junior Member, 1924).	Pathologist, Div. Forest Pathology, B.P.I., Wash., D. C.	Washington
Hedgcock, George G. Univ. of Neb., B.S., and M.A.; Wash. Univ. Ph.D. (Junior Member, 1927).	Senior Pathologist, B.P.I., Wash., D. C.	Washington
Hill, Robert R. Univ. of Neb., A.B. 1906; Post-graduate work in forestry and law, 1908-1910. (Junior Member, 1923).	Asst. to Chief of Range Mgnt., U.S. F.S., Washington, D. C.	Washington
Hurtt, L. C. Univ. of Neb., B.S.F., 1914. (Junior Member, 1932).	Assoc. Range Examiner, N.R.M. Forest and Range Exp. Sta., Missoula, Mont.	Northern Rocky Mt.
Jensen, Victor S. Univ. of Minn., B.S.F., 1925; Yale, M.F., 1928. (Junior Member, 1927).	Asst. Silviculturist, N. E. Forest Exp. Sta., New Haven, Conn.	New England
Joy, C. A. Univ. of Mont., B.S.F., 1926. (Junior Member 1926)	Assistant Supervisor, Deerlodge N.F., Butte, Mont.	Northern Rocky Mt.
Klehm, K. A. 2 years Ranger's short course, Montana. (Junior Member, 1929).	Assoc. Logging Eng., Kaniksu N.F., Sandpoint, Idaho.	Northern Rocky Mt.
Kramer, William P. Pa. State, B.S., 1919. (Junior Member, 1933).	Supervisor, Pisgah and Unaha N.F., Asheville, N. C.	Appalachian

Name and Education	Title and Address	Proposed by Section
Marshall, Robert N. Y. State, B.S.F., 1924; Harvard, M.F., 1925; Johns Hopkins, Ph.D. 1930. (Junior Member, 1925).	Dir. of Forestry, Office of Indian Affairs, Wash., D. C.	Washington
Martin, J. F. Mass. State, B.S. 1912, M.S., 1914, Ph.D., 1915. (Junior Member, 1928).	Senior Pathologist, B.P.I., Wash., D. C.	Washington
McLaughlin, R. P. Yale, M.F., 1926, Ph.D., 1932. (Junior Member, 1927).	Supt., Camp Roosevelt S60, Clinton, Conn.	New England
Melis, Percy E. Oregon State, 1923. (Junior Member, 1926).	Asst. Forester at Large, Indian Forest Service, Spokane, Wash.	Northern Rocky Mt.
Muck, Lee F. Univ. of Mich., 1913. (Junior Member, 1925).	Asst. Dir. of Forestry, Indian Service, Spokane, Wash.	Northern Rocky Mt.
Posey, G. B. Univ. of Md. B. S., 1912; Ore. Agric., M. S., 1915. (Junior Member, 1928).	Sr. Pathologist, B.P.I., Wash., D. C.	Washington
Potter, Arthur Univ. of Idaho and Univ. of Mont. (Junior Member, 1927).	Asst. Forest Supervisor, Boise N. F., Boise, Idaho.	Intermountain
Shepard, W. C. Cornell, B.F., 1907; Yale, M.F., 1907. (Junior Member, 1930).	Forester at Large, E.C.W., State of Conn., New Haven, Conn.	New England
Simpson, Alva A. Univ. of Calif., 1 year. (Eng.) (Junior 1927)	Forest Supervisor, Custer and Beaverhead N.F., Dillon, Montana.	Northern Rocky Mt.
Sowder, Arthur M. Univ. of Idaho, 1927. (Junior Member. 1927).	Asst. Prof. of Forestry, Univ. of Idaho, Moscow, Idaho.	Northern Rocky Mt.
Space, Ralph S. Univ. of Idaho, B.S.F., 1925. (Junior Member 1926)	Ranger at large, Blackfeet N.F., Kalispell, Montana.	Northern Rocky Mt.
Swenning, Karl A. N. Y. State, B.S.F., 1920. (Junior Member, 1923).	Forester and Mgr. of Woods Dept., The Mead Corp., Kingsport, Tenn.	Appalachian
Templar, J. N. 2 yrs. Eastman College, 1 yr. Normal. (Junior Member, 1927).	Forest Supervisor, Helena N. F., Helena, Mont.	Northern Rocky Mt.
Urquhart, J. C. 1½ yrs. Univ. of Mont. (Junior Member, 1926).	Asst. Supervisor, Lolo N. F., Missoula, Mont.	Northern Rocky Mt.
Watkins, William N. N. Y. State, B.S., 1916, some work toward M.F. (Junior Member, 1923).	Asst. Curator, Section of Wood Technology, U. S. Natl. Museum, Wash., D. C.	Washington
Weber, Charles G. N. Y. State, B.S., 1916. (Junior Member, 1927).	Asst. Chief, Paper Section, U. S. Bureau of Standards, Wash., D. C.	Washington

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Goodman, Robert B. Cornell, C.E., 1894.	Mgr. Goodman Lumber Co., Marinette, Wis.	Wisconsin
Ryerson, Knowles A. Univ. of Calif., B.S., 1917, M.S., 1924.	Chief, B.P.I., Wash., D. C.	Ohio Valley Washington Allegheny Appalachian

FOR ELECTION TO GRADE OF CORRESPONDING MEMBERSHIP

Gron, Alfred R. H. Harvard 1917; Copenhagen, M.F., 1923, Ph.D., 1931.	Prof. of Forestry, Royal Agric. College, Copenhagen, Denmark.	S. O. Heiberg L. W. Rathbun J. A. Cope
Hiley, Wilfred E. Queens College, B.A., 1908, M.A., 1911.	Mgr. Woodlands Dept., Dartington Hall, Ltd., Devon, Eng.	R. S. Hosmer H. H. Chapman E. N. Munns S. O. Heiberg
Johnson, Tor William Studenterexam. Skara, 1899; Jagnast., Skogsinstitut, 1903.	Prof. and Dean, Skogshogskolan, Djursholm, Sweden.	R. S. Hosmer E. N. Munns S. T. Dana S. O. Heiberg
Saari, Eine Armas Univ. of Helsinki, M.A., 1919, Ph.D., 1922. Also studies at Oxford, Yale and Columbia.	Prof. of Forest Economics, Univ. of Helsinki, Finland.	R. S. Hosmer H. H. Chapman E. N. Munns S. O. Heiberg

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Emanuel Fritz	Dec. 31, 1937	A. F. Hawes	Dec. 31, 1935
Ward Shepard	Dec. 31, 1937	C. F. Korstian	Dec. 31, 1935
S. N. Spring	Dec. 31, 1937	Hugo Winkenwerder	Dec. 31, 1935

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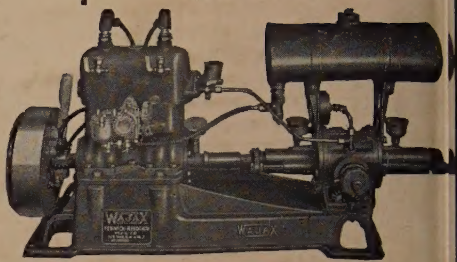

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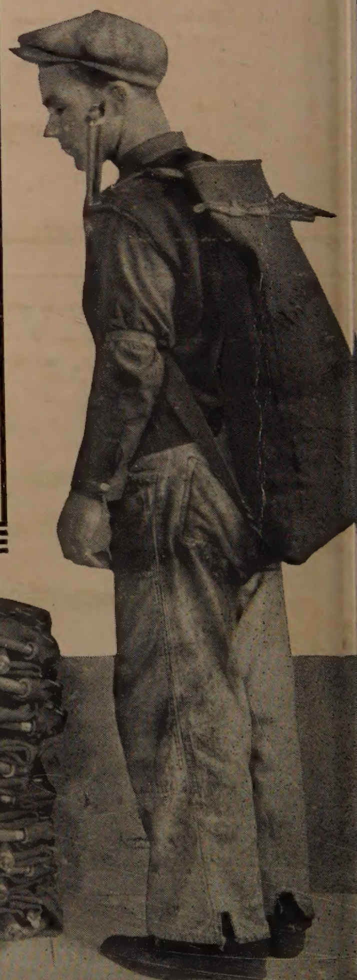

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